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VIEWS, NEWS AND INTERVIEWS.

Inventive geniuses who have attempted to generate electricity by wave power will be interested in a curious manifestation of its energy which is reported from the West. A young lady waved her handkerchief at a stranger, and in three days they were married. After another three days she waved a flatiron at her husband's head, and three days later he waved a divorce summons at her. She now has a chance to waive the charge.

The Wooliff electrolytic system of water purification, now used in bettering the water supply of New York city, may be adopted at Cincinnati.

A fakir, who follows a circus for a living, states, as a curious illustration of the general interest in electrical matters, that the proprietor of an induction coil can always find plenty of people willing to pay five or ten cents for a shock when other side attractions can't attract a customer.

"My father was afflicted with a curious malady," said a well known electrical man. "He was not a habitual stammerer, but he had great difficulty in pronouncing the word 'when.' It was absolutely impossible for him to speak the word when the odor of bourbon whiskey was adjacent. Many times have I tried the experiment with him of holding the mouth of a whiskey bottle over a glass, and as I began pouring, remarking to him, 'Say when, pop.' He would open his mouth, catch his breath, pant and contort his face, but would make no sound. Finally, after many efforts, he would gasp out, 'I c-c-cuc-cuc-can't sus-sus-sus-say whu-whu-whu-whu'—by this time the glass would be full and the experiment a failure. This peculiar affliction clung to him all his life. It was very curious, I assure you."

"The scarcity of currency is a serious question with us," remarked an officer of a large electric illuminating company in New York city. "Usually our daily receipts include $600 or $700 in cash, but during this money stringency we have been receiving about $50 in currency and the balance in all kinds of checks, notes and clearing house checks. As our pay roll is $10,000 a week, you can see that we need considerable currency to meet it. Last week the most we could scrape up from all sources was $6,000 in currency. We had to order through our bank $4,000 in currency, for which we paid 3¼ per cent. premium."

There are places where electric lights are a positive drawback. One summer resort by the sea has had its line of electric lights along the beach taken down, because so many of its patrons declared that it made the beach look so cityfied as to be unattractive.

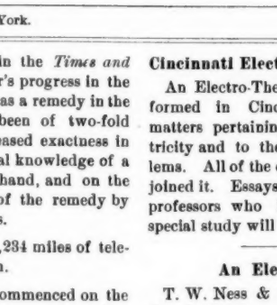
Dr. G. Betton Massey, in the *Times and Register*, says that the year's progress in the art of applying electricity as a remedy in the diseases of women has been of two-fold character, embracing increased exactness in an art requiring technical knowledge of a high order, on the one hand, and on the other an increased use of the remedy by conservative gynæcologists.

There are now about 3,234 miles of telephone lines in use in Japan.

Work will shortly be commenced on the Trans-African Telegraph, proposed by Mr. Cecil Rhodes. The contractors for the first portion of it, viz., from Salisbury to Tete, have recently left Cape Town.

Hereafter the offices of the General Electric Company's selling and manufacturing departments will be in New York, and of the accounting and collecting departments in Boston.

Paw Paw, Mich., has negotiated $15,000 electric light bonds, the Adrian savings bank being the purchaser. The bonds bear six per cent. interest, and one $500 bond is due and payable each year. The old Phœnix mill water power has been purchased and work will be commenced at once. Within the next 60 days, it is expected, the city will be running its own electric light plant.



DR. HERRMANN VON HELMHOLTZ, HONORARY PRESIDENT WORLD'S FAIR INTERNATIONAL CONGRESS OF ELECTRICIANS

ALEXANDER SIEMENS, OF LONDON.

PROF. SYLVANUS P. THOMPSON, OF LONDON.

The entire force of employés in the foundry and factories of the General Electric Company, West Lynn River Works, has been discharged. The iron foundry was closed some time ago, but now the steel foundry, pattern shop, carpenter shop and machine shop are closed for an indefinite period. About 250 employés are affected. The River Works were erected at a great expense, and contained the most modern machinery.

Cincinnati Electro-Therapeutic Society.

An Electro-Therapeutic Society is being formed in Cincinnati. It will discuss matters pertaining to the science of electricity and to the solution of knotty problems. All of the electricians in the city have joined it. Essays and addresses from college professors who have made electricity a special study will be read.

An Electrical Picnic.

T. W. Ness & Company, a well known electrical house of Montreal, Que., have established a series of electrical picnics to be given annually. The first was held on August 26, at St. Rose, Montreal, and was a great success.

The New Cable to the Azores.

King Carlos, accompanied by his family and all the cabinet ministers, at Lisbon, on August 27, opened for business the new cable between Portugal and the Azores.

LITERARY.

"Reports from the Consuls of the United States," for August, 1893, has been received.

Scribner's Magazine for September contains 16 titles in prose and verse, seven of them illustrated. The artists represented include Arthur Parsons, A. E. Sterner, W. L. Taylor, O. H. Bacher, J. H. Twachtman and C. S. Reinhart. With such notable artists the number is remarkably rich and attractive in its pictures.

A new section of switchboard has been added to the telephone exchange at Burlington, Ia. Other improvements have also been made.

THE ELECTRICAL CONGRESS.

Enthusiasm Marks the Meetings of the World's Fair International Congress of Electricians.

ADMIRATION FOR VON HELMHOLTZ—PROF. GRAY'S SPEECH—PROF. AYRTON'S ADDRESS—OTHER REMARKS—A RUNNING ACCOUNT OF THE PROCEEDINGS AND PAPERS READ.

Monday, August 21.

In the Hall of Columbus, at the Art Institute, Chicago, at three o'clock P. M., on Monday, August 21, Prof. Elisha Gray, chairman of the Advisory Council of the World's Fair Congress of Electricians, escorted Dr. Herrmann von Helmholtz, the great German scientist, to the platform. The sight evoked a burst of applause from the large audience present. When the 500 invited guests had taken their seats on the platform, and after Von Helmholtz had bowed repeatedly until the applause quieted down, Prof. Gray stepped forward, struck the desk with his gavel, and began his remarks, which opened the Congress. He said, in substance:

The rapid strides that have been made in electrical science and electrical invention in the last 25 years have marked a new era in our civilization, and this age may well be denominated the electric age. Who knows what the next quarter of a century will bring to us through the medium of electricity? To some people it seems as if the limit were nearly reached, but who knows? The grand results that have thus far been attained were not accomplished by any one nation or individual. We, as Americans, are proud of our native land—the land of Franklin, Morse and Henry—but we are also proud of our fatherland, and we believe the fatherland is just a little proud of us, although we neither of us say this too often or too loud. The fatherland of America is all the civilized world outside of its own borders. We are proud of an ancestry from which spring such men as Faraday and Lord Kelvin, Ampere and De la Rive; such men as Galvani and Volta; and last, but not least, we are proud of an ancestry that produces such men as our honored guest, Dr. von Helmholtz. I now surrender this Congress into your hands, feeling assured in advance that the work will be eminently worthy of such a representative body of electricians.

At the conclusion of Prof. Gray's address he said that the first thing in order was the election of a temporary chairman. Mr. Preece then rose and said:

I have been asked, as the first duty connected with this Congress, to propose to you briefly the election of a temporary chairman, and I propose for that office a gentleman of whom we are very proud in England, for he was born there; a gentleman of whom you are very proud in America, for he lives here and has made his reputation here. I propose for temporary chairman, Prof. Elihu Thomson.

Prof. Thomson was unanimously elected, and accepted the temporary chairmanship in these words:

I thank the Congress very much for calling me to the chair at this time, even though it be but the temporary chairmanship. I certainly would be fully repaid at any time in any gathering of this kind in doing anything I could to favor its plans and to carry on its pursuits.

We are gathered here as representatives of the departments of that grand science which, though not in its infancy—as we sometimes see the newspapers state—has yet the power of youth and the power of unceasing youth, as we believe, in the time to come. It is that science which, when we visit the grand collection of man's industrial achievements at Jackson Park, we are proud of it; it is that science which has made such a collection and such an exhibition even possible. If an attempt had been made fifteen years ago to produce the results which are there exhibited, where should we have been? Everywhere that you go you will find

evidences of the work of electricity—all accomplished within this brief period of years. Yet many of the principles of them were known long before, and we bow to the army of workers who have brought about this grand success. Many of the prominent ones have passed away.

In relation to a remark made by Dr. Gray, that there was not very much more to learn, that somebody had been born too late, I called to mind an expression I found in an old book in regard to electricity. I think it was a book on physics, printed a hundred years ago. The statement in the book was that the advances had been so rapid and so numerous that it really did not seem that there was any direction in which discoveries were likely to be made in electricity. All that the book dealt with was the old frictional machine, the Leyden jar, and a number of luminous experiments on vacuum tubes, etc. Shortly after the publication of that book there came along the whole of the discoveries in voltaic electricity, opening up that very wide field, which has gone on expanding up to the present time, and which will go on, following the development of that field and opening up what we call the dynamo-electric field, which is really an extension or expansion of the voltaic theory. But to-day we recognize no such distinctions. The electricity of to-day is one and the same thing, whether you see the current under the thousands of amperes in field masses of metal together, or whether you see the lightning striking from a thunder cloud to the earth. In both you see the same thing, only in one instance you have no pressure and enormous volume, just as a great river flows on without having any apparent head or anything to force it along; and in the other case you have enormous pressure and a very small amount of volume.

It is the glory of all science that it works not only to discipline and enhance the intellectual advancement of man, but it also confers practical benefit, and it is the peculiar glory of electrical science that study it, delve in it merely for mental discipline, and you will find it one of the best exercises imaginable. If you work in it for practical uses you will find that it has the possibility of ramification into innumerable fields. It is almost an universal science.

Can you wonder then that we are enthusiastic, that we are proud to work in a field of this kind? It is the modern kind; the field which will in the future give us the power to do things which to-day we cannot conceive possible. Beginning with small things, beginning sometimes with merely theoretical developments—developments of very little practical interest, we find as time goes by those very things becoming of practical use. And so it is with science in all its departments: no part of it can be considered as useless from a practical standpoint.

Let us then unite in making this congress a memorable occasion, a celebration, as it were, of the past 15 or 20 years, and the years that have gone before that period in the grand developments which have taken place in electrical science. The best way to do that is to exchange ideas and discuss points of difference of opinion, or of unanimity of opinion, if you please, and endeavor to spread information abroad and extend the sphere of our knowledge.

We have with us to help out in this grand and good work men of distinction from every clime. We have some with us who have earned the highest distinctions, and I am glad to say that they will be of the greatest assistance to us Americans who attend largely to practical work, in keeping us out of altogether practical ruts.

The order of business for to-day will be first the election of a temporary secretary.

Prof. F. B. Crocker, of Columbia College, New York, was elected temporary secretary on motion of Prof. Charles R. Cross. The chairman then appointed this committee on permanent organization: Dr. T. C. Mendendhall, Washington, D. C.; Prof. Benjamin F. Thomas, Columbus, Ohio; Dr. Louis Duncan, Baltimore, Md.; Dr. S. P. Thompson, England; Prof. E. Hospitalier, France; Dr. A. Lindeck, Germany; Dr. A. Pallaz, Switzerland.

Prof. Thomson then called upon Prof. Wm. E. Ayrton, of London, to give his views of the World's Fair from a foreigner's standpoint.

While the Committee on Organization was preparing its report, Prof. Ayrton was introduced and made the following interesting remarks:

Chicago is a long way from the seas. The stranger's opinion of the electric display of America com mences to be formed long before he arrives at the White City. The glow lamps which he sees lighting even your scattered houses, the arc lamps which he sees burning even in your country lanes, the electric tramways rapidly carrying the working population of your cities into healthy suburbs in the evening when their day's work is over—all these fill the stranger with admiration, and he feels pleased that you have no Board of Trade to control your affairs. But when in a city like Baltimore he finds that the roads which are destined to become electric have been converted into Alpine Mountain passes by the construction of the electric tramways; when he sees jumbled up in the same passes telephone, telegraph and high pressure electric wires, sometimes insulation becoming a little defective, he becomes reconciled again to the dominion of Whitehall, and he finds comfort to himself from the fact that high pressure transformers are not stacked like flies on the house walls in his own country. When he learns that the load on the down-town electric lines in New York is at a maximum at 2 o'clock in the afternoon his mouth waters at such a paying road, and he would rush to take shares in such a prosperous undertaking but for the recollection that a 10 per cent. or 1 per cent. dividend comes to the same thing when there is no currency whatever to pay the dividend they declare. He visits Pittsburgh, Cleveland, this stranger, and he is as much astonished with the courtesy with which he is shown every detail in the factory as by the magnitude of the undertakings. His expectations are roused to such a pitch that he expects, when he comes here to Chicago, to find an electric display which will cast all previous electrical exhibitions into the shade.

Well, take this stranger into the Electricity Building blindfolded so that his judgment may not be warped by the glories of the outside surroundings, and leave him there, and after a while, if he be candid and if he can muster up courage to say a word which might cause pain to those whose kindness has made them dear to him, he will say that he is a little disappointed that the world has not better answered the invitation to show the Electricity Building what it could do. If he is an Englishman he is not only disappointed, but rather ashamed of his country. And even looking at the electrical exposition, that is Electricity Building, from purely an American standpoint, if you allow me to say so I don't think it quite does—the exhibits inside do not quite do—this country justice.

The stranger feels that the real electrical display of America is not in Electricity Building, but in every street where there are trolley wires, in every town and village where there are electric lights, and where is the town in this country where they are not?

But if the stranger be thoughtful he is not disappointed. In Frankfort it was what was inside the Electrical Building that dazzled the mind; at Jackson Park it is what is outside the Electrical Building that rivets his attention. One fears that the bustle and hurry of this country would not allow time for their appearing in the program of its development of the development of those charms that America comes to Europe to witness, but when I saw your Exposition—when from the top of Manufactures Building I looked down at night on your court of honor, on the tracery of electric lamps, more beautiful in its realization than could have been even but dreamed by the writer of the Arabian Nights, then I felt pleasure that in that great loving hospitable heart which throbs in the breast of the go-ahead people of this country there must be some nook where lurks the belief that powerful as is machinery, powerful as is electricity, the song, the poem that echo, and the statute that lives when the bones of its creator have tumbled into death, are even more powerful still in forming the history of humanity. But your exhibition makes me hope that the love of art and poetry for their own sake, which we have hitherto regarded as the heritage of poor and oppressed races, like those of Italy, Hungary and Russia, will become the heritage of this great free nation.

The permanent officers of the Congress were reported from the committee on permanent organization by Prof. T. C. Mendenhall as follows:

Honorary president—His Excellency Dr. Herrmann von Helmholtz, of Berlin, Germany.

Permanent chairman—Dr. Elisha Gray, of Chicago.

Vice-presidents—Edward Weston, United States; W. H. Preece, F. R. S., Great Britain; Prof. E. Mascart, member of the Academy of Science, France; Dr. Voigt, Germany; Prof. J. Sahulka, Austria; Prof. Galileo Ferraris, Italy; Prof. H. Weber, Switzerland.

Permanent secretary—Prof. F. B. Crocker, New York.

By this time the Committee on Organization was ready to report. Chairman Mendenhall said the Congress could not honor Prof. Helmholtz, but it would honor it itself by electing the great Scientist Honorary President. When the audience had grown weary of applauding, Prof. Mendenhall continued that Prof. Elisha Gray had been nominated for chairman to do the active work. Prof. Gray's name was also heartily applauded. Prof. F. B. Crocker, of Columbia College, was made secretary, and it was announced that a vice-president would be named from each of the nations represented. As all the credentials had not been presented the list could not be completed. These nominees were elected by acclamation.

Then Prof. Gray introduced the honorary President, Prof. von Helmholtz, when the demonstration already described ensued. As Prof. von Helmholtz stood bowing and waiting to be heard, a slight smile lighting up his face, it could be seen that he was just a trifle under the medium height and a little bit portly. He speaks English readily with but little of the German accent. When he could make himself heard he said:

Ladies and Gentlemen: I must say that I feel nearly more ashamed about these excessive honors which you give me, so that I am not quite assured that I have necessary merits. I have been occupied by electricity, that is true, and, perhaps, age has this privilege, that it is honored more than youth even if the merits should be doubtful. Now, I think at present I am the most aged man of the present electricians.

The beginning of my career was when the phenomena of electricity were most delicate experiments, which were performed by some physicists in their laboratory. We can move at present great machines of the greatest power, and at the time when I began to study electricity we could not move a little magnetic needle suspended on a silken thread, the finest which we could find. We balanced two such needles with opposite poles to get any token of an electric current. The most delicate token or index of the electric current was the galvanized frog. He could do nothing more than make an oscillation, a contraction. We could not move the slightest apparatus, but we showed that there were feeble currents, and we had no constant electromotive force. We were obliged to work with the simple elements of copper and zinc, without sulphate of copper, elements which altered every moment, which had in the first instance a great electromotive force, then went down and down, and down, so that after some instances there was nearly no force at all, only traces of the former force.

Now, all this is altered. In the beginning of my career, when we did not know anything of the great discoveries of Faraday, of the use of currents which have developed into currents which can drive, the mightiest engines, I may say that the present generation, if I include myself into the present generation [laughter], has seen a greater development of science than any generation before us. The history of the world and the history of science has grown rapidly during our lifetime, and it is a great pleasure for us old men to see now what electricity has reached in its new stages, and to admire the newest developments which are collected on this festival occasion here in your great Exhibition. I thank you.

W. H. Preece, of London, made a brief speech and was followed by Professor Mascart, delegate from France, who asked permision to address the audience in his native tongue.

At this point the general session adjourned. Immediately afterward the chamber of delegates, consisting of the official government delegates from the various nations represented, met in Hall 4 to form a preliminary organization for its meeting the next day. This chamber of delegates met at the Grand Pacific Hotel in secret session.

Tuesday, August 22.

Prof. Charles R. Cross, of the Massachusetts Institute of Technology, Boston, presided in Hall 7, where Mr. W. H. Preece, F. R. S., read a paper on "Signaling Through Space by Means of Electro-Magnetic Vibrations," of which the following is a comprehensive abstract:

In 1885 Mr. Edison showed how it was possible to communicate with a moving train by utilizing the electrostatic influence between a circuit erected upon the poles on the side of a railway and a telephone circuit carried by the train. In the same year I made many experiments to determine that many of the effects observed in England were due to electro-magnetic induction, and were quite independent of the earth, and also to find out how far the distance between the wires could be extended before this influence ceased to be evident. With our ordinary telegraph working currents the region of disturbance reached a distance of 3,000 feet, while the effects were detected on parallel lines of telegraph 10½ miles apart. It is a necessity at the outset to point out that if we have two parallel conductors separated from each other by a finite space and forming part of a separate and distinct circuit, either wholly metallic or partly completed by the earth, and called respectively the primary and secondary circuits, we may obtain currents in the secondary circuits either by conduction, or by induction, and we may classify them into those due to first, earth currents; second, electrostatic induction; third, electro-magnetic induction. When a linear conductor dips at each end into the earth, with which it makes a good connection and voltage is impressed upon it by any means, the resulting return current would probably flow through the earth in a straight line between these two points if the conduction of the earth were perfect. But as the earth is a very poor conductor, lines of current flow spread about symmetrically in a way that recalls the figures of a magnetic field. These diffused return earth conduction currents are evident at great distances.

The primary current is best produced by alternating currents of such a frequency as to excite a distinct musical note on a telephone, and if these currents rise and fall periodically and automatically they produce an unmistakable wail. If they are made and broken by a Morse key they can transmit readable signals. The secondary circuit, which contains the receiving telephone, is completed in the case of the earth by driving two rods into the ground, or in case of water by plates dipping into the water at a distance of from five to ten yards apart.

Since 1885 I have made a vast number of experiments to thrash out the laws and conditions that determine the distance at which these magnetic disturbances can be usefully evident. Although communication across space has been proved to be practical in certain conditions, these conditions do not exist in the case of isolated lighthouses and lightships, cases in which it was especially desired to provide. The length of the secondary must be considerable, and for good effects at least equal to the distance separating the two conductors. Moreover, the apparatus to be used on each circuit is cumbrous and costly, and it may be more economical to lay an ordinary submarine cable. Still, communication is possible, even between England and France across the channel, and it may happen that between islands, where the channels are rough and the bottom rocky and the tides fierce, the system may be financially possible.

It is, however, in time of war that it may become useful. It is possible to communicate with a beleagured city, either from the sea or on the land, or between armies separated by rivers, or even by enemies.

A use to which these electro-magnetic disturbances can be applied is to indicate to ships their contiguity to lighthouses and land falls. Mr. Stephenson, of the Northern Lights Commission, is making experiments in this direction on the coast of Scotland. He proposes to submerge a cable on a given fathom line through which special automatic distinguishing signals are sent so that a ship approaching or crossing this line can pick up these signals on board and learn its true position. I have also pointed out that as these waves are transmitted by the ether they are independent of day or night, of fog or snow or rain, and therefore, if by any means a lighthouse can flash its indicating signals by electro-magnetic disturbances through space ships could find out their true positions in spite of darkness and of weather, fog would lose one of its terrors and electricity becomes a great life-saving agency.

A long discussion followed, led by T. D. Lockwood, of the American Bell Telephone Company. Mr. Lockwood said that he thought communication by electro-magnetic vibrations was feasible, and that there was great use for such methods of transmission. Mr. Heavyside, who assisted Prof. Preece in all his experiments, told how this method of communication had been used between the bottom of a colliery 60 fathoms deep and the surface of the earth, where other means were not practicable. It was an entire success.

Prof. Sylvanus P. Thompson's interesting paper on "Ocean Telephony" then followed and created great interest. It is published in full elsewhere in this issue.

Wednesday, August 23.

The third day of the Congress opened auspiciously with a large crowd in attendance, all eager to hear the discussion of Prof. S. P. Thompson's paper on "Ocean Telephony." This was held in section B, the other two rooms being practically deserted. The paper was subjected to a great deal of criticism, dealing as it did with a practical subject in a theoretical manner. The great expense arising from any extended experiments in order to prove the theories would cost so much that it is to be doubted whether any practical results will arise in the very near future.

At yesterday's session it was decided to have the discussion of this paper to-day, and for this reason the attendance was larger. Mr. Charles Cuttriss, the electrician of the Commercial Cable Company, who has had probably as much experience with cables as any other worker in that direction, spoke of Prof. Thompson's researches as being commendable, but thought, as did Mr. Alexander Siemens, that the great cost would prevent any extended experimentation. Prof. Thompson seemed rather uncertain in several of his points concerning the cost of cables, if we may rely upon the statements of Mr. Siemens.

Prof. Jamieson, Alexander Siemens, Charles Cuttriss, A. E. Kennelly and others discussed the paper at length, but at the end it was doubtful whether any advances had been made or any decidedly new facts elicited. Many of the points stated by Prof. Thompson are well known to cable workers, and while the paper itself shows the master touch of the author, it can be said, if we may judge from the numerous expressions of opinion heard afterwards in the corridors, there are theories advanced which might not bear out the hopes expressed in their advancement. But electricians are not in the habit of falling in with any theory that may come along without investigation, so it came that there was a small army of men from England, Germany and America who wanted to know about it. They asked Prof. Thompson questions until his brain reeled; they picked flaws in his deductions until he winced; they turned the searchlight of criticism upon his theories until he smiled a desperate sort of smile.

Then Prof. Thompson replied to every point advanced against him and to every question in detail. By an adroit sally he brought out a vociferous laugh at the expense of one critic, and won the sympathy of the audience; then with masterly skill he straightway turned the ambiguous witticism into a handsome compliment and won the heart of the victim.

When Prof. Thompson sat down at last, the outburst of applause showed that his defense of his paper was considered effective; that, however they may differ from him on minor points, the great majority of those present believed he had made a great discovery. Prof. Jamieson, of Scotland, complimented Prof. Thompson on his paper, but thought his plan impracticable from a commercial standpoint on account of the cost. H. W. Heavyside, of England, believed Prof. Thompson's discovery to be of the greatest scientific and commercial importance. His experience in connection with the British telegraph system since 1877 confirmed the principles laid down. Mr. Wilkinson, engineer to the British World's Fair Commission, thought Prof. Thompson had found a satisfactory solution of the problem of ocean telephony.

Professor Thompson told of experiments upon a cable between Sierra Leone and the port of Bonne, a distance of 1,700 miles. The result of these experiments proved that by carefully gauging inductive leaks resistance can be practically wiped out. Even granting that the eight Atlantic cables now in use were capable of conveying 25 words per minute, which all of them are not able to do, there was no reason why they should not do much more. He also denied vehemently that the cost of his cable rendered it commercially impracticable. "All I have claimed," he concluded, "is to improve the speed of signaling, and I hope to so improve it as to make it possible to talk from shore to shore."

Dr. Stephen Lindeck, of Charlottenburg, Berlin, read a paper on "Materials for Wire Standards of Electrical Resistance." The announcement of the subject was the signal

for a hegira of the delegates, but to the few that remained Dr. Lindeck read his paper. A short desultory discussion followed. Then A. E. Kennelly read a paper on a kindred topic, "Some Measurements of the Temperature Variation in the Electrical Resistance of a Sample of Copper."

Over in Section A, where pure theory held sway, Prof. Henry A. Rowland presided over a corporal's guard of electricians. Three papers were read at this meeting, one by Prof. A. MacFarlane, one by Charles Steinmetz, and one which was the joint production of Dr. Frederick Bedell and Dr. Albert Crehore.

Prof. E. J. Houston presided over Section C. Sometimes he had a houseful, sometimes he gazed at empty benches, according to whether the subjects under discussion were found interesting or otherwise. Prof. D. C. Jackson, of the University of Wisconsin, read the first paper of the morning on "Underground Electric Construction." A long discussion followed; then L. B. Marks, of New York city, a youthful looking graduate of Cornell University, now connected with the Royal Arc Electric Company, read a paper on "A New Incandescent Arc Light." In this new light the electrodes are not in contact; they are surrounded by an envelope made of highly refractory glass which is insulated from the electrodes. This lamp glows like the incandescent lamp with the brilliancy of the arc light. The arc proper is scarcely visible, but the entire contents of the chamber seem to be luminous, giving the appearance of a solid cylinder of light. He was highly complimented for these researches by Prof. Thompson and others. This paper will appear in full in the REVIEW next week. Dr. J. C. Sahulka also read a paper on "Various Uses of the Electrostatic Volt-Meter."

In the afternoon the electricians went to Jackson Park on the whaleback. They examined the movable sidewalk, the Intramural railway, and many other points of interest.

Thursday's Session.

The majority of the attendants this morning attended the exercises in Section C, where papers on pure practice were read.

Long distance transmission of power was the subject up for discussion, with Prof. E. J. Houston in the chair. The entire time of the session was given over to this most important subject, and it was interesting to watch the eagerness on the faces of those present to hear solutions of this much vexed problem. The anxious look, however, was due not only to this cause, for the numerous passing locomotives of the Illinois Central Railroad caused such a din that it was only by the merest chance that those in the rear of the room heard the remarks of the speakers.

When it is known that the World's Fair Commissioners paid for the Art Institute the enormous rental of $200,000 for the six months of the Fair, and that there are 33 rooms in the building, in most of which it is impossible to hear while the trains are passing, and there is continual traffic on the line, it will be realized that, to use a very pertinent phrase, there is a screw loose somewhere. However, the speakers exerted themselves to the utmost under the many calls of "louder."

The whole discussion on this subject may be summed up in a few words, for it may be said that the consensus of opinion among the leaders was that long distance transmission of power was coming, and that the polyphase system was not the best; that the single phase must be relied on in the future.

Sylvanus P. Thompson said on this point: "For distribution purposes we will have to abandon all the complications of the multiphase system and return to the simple alternating current."

As nearly everybody was interested in the discussion in Section C, there were not many left to attend Section A, where Dr. H. T. Eddy, President of Terre Haute Polytechnic Institute, presided in place of Prof. Rowland. Theoretical papers were presented by Dr. J. Sahulka, A. Blondel, and Prof. W. E. Ayrton, F. R. S.

The audience ranged in front of Professor Cross' desk in Section B was a variable quantity. Dr. Frederick Bedell, Prof. H. S. Carhart, A. E. Kennelly and Prof. J. A. Ewing, F. R. S., read papers. Then came a short recess. When the section reassembled Prof. Andrew Jamieson, of Glasgow, read a paper on "London Electrical Eegineering Laboratories." Professor Jamieson is professor of electrical engineering in the Glasgow and West of Scotland Technical College.

Friday Morning Session.

Prof. George Forbes, electrician for the Cataract Construction Company, who has charge of the construction of this largest plant in the world, attended the session in Section C, where he spoke of what he had been doing in connection with the Niagara Falls Power Station. The substance of his remarks were given to a representative of the REVIEW, in an interview with Professor Forbes, which appeared in the issue of February 25, 1893. Briefly stated, they were as follows:

The canal commences one mile above the Falls. From this main canal branches lead to factories and to the power house for electric distribution. The water falls through penstocks 140 feet deep, at the bottom of which are turbines with vertical shafts. All discharge water goes into a large tunnel opening below the Falls. The revolving field magnets of the dynamo are directly on the same vertical shafts. The armatures of the dynamos are stationary and are wound so as to give directly a pressure of 20,000 volts, thus dispensing with transformers at the generating station. At the receiving stations the pressure will be lowered by transformers to a safe pressure to handle. The same pressure on the mains will be used for distribution to points near and at a distance in order to avoid complexity of wiring and to save copper. The wires will be carried partly on poles and partly in subways. The aim is ultimately to supply power not only to factories in the vicinity of the falls, but to Buffalo, Rochester, Utica, Syracuse and Albany, and perhaps also to supply power to propel the boats on the Erie and other canals in New York State.

Prof. Forbes thought the matter of towing by electricity on the Erie Canal would make transportation so cheap that it would revolutionize carrying business in New York State. Last Friday the first sod was turned on the subway that will transmit power for the Cataract Construction Company to the Pittsburgh Reduction Company's works, one-half a mile distant. He thought a saving of $3,000 each would be effected by building the dynamos without transformers.

Prof. Rowland, of Johns Hopkins University, objected to Mr. Forbes' statements. He thought that instead of saving $3,000 by dispensing with transformers, it would be just the other way, on account of frequent breakdowns due to the absence of the transformers.

Prof. Jackson said we were all familiar with the transmission of power over short distances. He hoped in two or three years we would know just where we stood on long distance transmission and distribution.

Dr. Bell thought the utilization of electricity for towing on the Erie Canal was not so near as might be. The overhead line would be difficult to keep up, and the conduit was commercially impossible. We must employ overhead bare wires. No insulation that could be put on would stand high voltage. In theory the conduit was all right, but commercially its cost prohibited it. As regards the distance over which power could be transmitted, he did not think any one would care to set the limit. A distance of 50 miles and under was enough to keep all busy for the next decade. If only coal was cheap enough power could be transmitted any distance. It was thus of more a commercial than an electrical problem.

In Section B, as on the day before, the attendance was rather light, owing to the fact that every one wanted to hear the discussion on long-distance power transmission. Prof. W. E. Ayrton, F. R. S., delegate from England, read a long paper on the variation of potential difference of the electrical arc current, the size of the carbons and the distance apart, which was copiously illustrated with diagrams. Prof. B. F. Thomas read a paper on "Periodic Variation of the Candle Power of Alternating Arc Lights." Jules Violle read a paper on "Light and Heat of the Arc." A number of speakers commented on the papers read, among them being Prof. Sylvanus P. Thompson, who told of experiments in which electrical energy equal to 16 horse-power had been condensed into one cubic inch. Prof. Elihu Thomson told of some interesting experiments with the heat of the arc. He bored holes in carbons, in which he put small quantities of iridium. On turning on a strong current the iridium was volatilized instantly. Sapphires and other almost infusible substances were easily welded by the same process.

Friday Afternoon Session.

For the second and last time during the week all the delegates assembled in one hall, the Hall of Washington. They had assembled to hear the report of the Chamber of Delegates on what they had accomplished, and to be formally dismissed. Prof. Helmholtz was there in the center of the stage. Grouped around him were Elisha Gray, Elihu Thomson, W. H. Preece, G. Ferraris, A. Palaz, W. E. Ayrton, Dr. T. C. Mendenhall, H. A. Rowland and others.

For the first time America was honored by the bestowal of the name of one of its great electricians upon an electrical unit. France has been recognized in the Ampere, Italy in the Volt, England in the Watt, now America has been recognized in the Henry. The name "Henry" has been given to the unit of self-induction in honor of Prof. Joseph Henry, formerly professor in Princeton College, and afterwards Secretary of the Smithsonian Institution, at Washington. Prof. Henry was the first to observe the phenomenon for the measurement of which this unit is used, and ranks as one of the great early discoverers in the field of electricity.

The report from the Chamber of Delegates contained the following:

Resolved, That the general governments represented by the delegates in this International Congress of Electricians be and they are hereby recommended to formally adopt as legal units of electrical measure, the following:

As the unit of resistance, the international ohm, which is based upon the ohm equal to 10^9 units of resistance of the initial C. G. S. system of electromagnetic units, and is represented by the resistance offered to an unvarying electric current of a column of mercury at the temperature of melting ice, 14.4521 grammes in mass, of a constant cross sectional area, and of a length of 106.3 centimeters.

As a unit of current the international ampere, which is $\frac{1}{10}$ of the unit of a current of the C. G. S. system of electro-magnetic units, and which is represented sufficiently well for practical use by the unvarying current, which, when passed through a solution of nitrate of silver in water, in accordance with accompanying specifications, deposits silver at the rate of 0.001118 of a gramme per second.

As a unit of electromotive force the international volt, which is the electromotive force that steadily applied to a conductor whose resistance is one international ohm will produce a current of one international ampere, and which is represented sufficiently well for practical use by 1,000-1,434 of the electromotive force between the poles or electrodes of the voltaic cenn, known as Clark's cell, at a temperature of 15° C., and prepared in the manner described in the accompanying specifications.

As the unit of quantity the international coulomb, which is the quantity of electricity transferred by a current of one international ampere in one second.

As a unit of capacity the international farad, which is the capacity of a conductor charged to a potential of one international volt by one international coulomb of electricity.

As the unit of work the joule, which is 10^7 units of work in the C. G. S. system, and which is represented sufficiently well for practical use by the energy expended in one second by an international ampere in an international ohm.

As the unit of power the international watt, which is equal to 10^7 units of power in the C. G. S. system, and which is represented sufficiently well for practical uses by the work done at the rate of one joule per second.

As the unit of induction the henry, which is induction in a circuit when the electromotive force induced in this circuit is one international volt while the inducing current varies at the rate of one ampere per second.

Dr. Nichols also presented a report of the committee appointed to consider the question of standards of light. The committee says it has had much discussion upon the various forms suggested for standards and in particular upon the two special forms of lamp known respectively as the amyl-acetate lamp of Von Hefner Alteneck and the pentane lamp of Vernon-Harcourt. It was unable to arrive at a vote recommending either, however, and therefore recommended that all nations be invited to make researches in common on well defined practical standards and on the convenient realization of the absolute unit.

After the reports had been read and adopted, W. H. Preece, of England, extended an invitation to the members of the Congress to meet him at the Victoria House, on the World's Fair grounds, at 5 o'clock this evening, where he will hold a reception.

Baron von Helmholtz then arose and said:

We have performed a really important work, and one which I hope will bear good fruits for the future in correcting the incongruities of electric science, so that all scientific and industrial men can understand each other in the simplest and best way. It was rather a hard piece of work to do in continuous meetings of the delegates and members of the Congress, and he who has had the greatest part of the exertion and labor in this connection is our President, Mr. Elisha Gray. Therefore, I trust you will express to him your thankfulness, and I move that we extend to him a vote of thanks.

The motion was seconded by M. Mascart, of France, who spoke in his native language. He said:

My associates join me in heartly seconding the proposition of Baron Von Helmholtz to express our thanks to the distinguished President of the Congress of Electricians. We have admired the urbanity, grace, and ability with which he has conducted the work, and are grateful for the courtesy with which he has treated us, and for all the hospitality and kindness that we have received in America.

The motion was put by W. H. Preece, of England, and was unanimously carried. In a brief response, Prof. Gray said:

I cannot tell you how gratifying this is to me. I have worked for the last two years in organizing this Congress under many difficulties, and those difficulties have continued right up to the present moment. Those locomotives outside do not even give us a chance to express ourselves. And I want to thank you before we leave. I want to thank the members of this Congress for the part they have taken. I want to thank you for the kindly spirit in which you have accepted all the difficulties under which we have had to labor. I think upon the whole the Congress has been very successful, and I trust that you will go away feeling that this is true and that you will think of us kindly, and you gentlemen who come from foreign shores, when you go home and look back, do not think only of smoke, of noise and high buildings, but think of us over here as having warm hearts, as wishing you well, and that we are all praying that you will have smooth seas and a warm-hearted welcome home to your friends and dear ones.

This closes the work of the International Electric Congress for 1893, and I declare it adjourned.

Tesla's Lecture.

On Friday evening Nikola Tesla delivered a lecture on "Mechanical and Electrical Oscillators." He said one of the main springs which drove him into the inventions he proposed to exhibit was the hope of finding a way to transmit intelligence by sending currents through the earth. He then described the evolution of the idea until, after long continued experiments, he secured vibrations of the air, which would tear apart steel rods one-quarter inch thick. He first thought to combine the apparatus with a magnetic field. He then exhibited what he called an oscillator, which is a motor driven for purposes of experiment by compressed air, in which an air cushion was used to secure regularity of motion. The pressure in this air cushion reached 16 tons at the end of the stroke, which was short.

The apparatus on exhibition made eighty vibrations a second, but he had constructed others that made 5,000 to 10,000 a second. It was easy to secure any kind of oscillation desired which would be perfectly constant, so constant that a clock could be run by it. He had intended to show the clock operated by the oscillator, but it had been broken in transit.

When the lecturer said there were many applications of this oscillatory principle, and that it would produce a current that would never be affected by varying load or by any other condition, the assembly of eminent scientists applauded long and loud. He attached a magnet to the oscillator, and, placing a copper disk between the poles, exploded an old theory that the currents in the metal would not be affected. The chief employment of his mechanism, he said, would be to produce an electric current. He would produce at a central station a current of a great many periods, and at points on the line could be placed synchronous motors that would run with perfect regularity—regularly enough to run clocks if need be. In a word, he had found a way of producing a current of absolutely constant periods.

Mr. Tesla, after the lecture, gave an invitation to the members of the Congress to witness some experiments which he expected to

(Continued on page 22.)

OCEAN TELEPHONY.

BY SYLVANUS P. THOMPSON, BEFORE THE ELECTRICAL CONGRESS, CHICAGO.

THE PAPER THAT ATTRACTED THE MOST ATTENTION.

I.—INTRODUCTORY.

It is contrary to the scientific spirit of progress to admit that any art or application of science can stand still, or that any of its developments are final. To bridge the ocean by an electric telegraph was a mighty achievement. To speak through a wire the audible syllables of language was a marvel. To accelerate telegraphic transmission by automatic devices until a speed of even 500 words per minute was attained was a bewildering accomplishment. But with the attainment of these three tremendous strides, finality has not been reached. The ocean cable of to-day is practically unchanged from what it was 30 years ago. It speaks only with the still slow signals of the mirror galvanometer, or of the siphon recorder. Six or eight words per minute slowly spelled out are the usual limits of working of an Atlantic cable. The spoken telephonic word, and the rapid automatic telegraphic message are too nimble for it. For such rapid signaling it is dumb. That a submarine cable clad in its coating of gutta-percha would retard the rate of signaling was predicted by Faraday, and verified when the first long cable was laid. Many have been the subsequent devices to increase the speed of signaling by the use of condensers and the like. They have all been devices to be applied either at the transmitting, or at the sending end, or at both. Arrangements of condensers and resistances so combined as to act as an artificial cable, imitating the retardations of an actual cable, have been found indispensable adjuncts for balancing the properties of the cable in order to adapt it for duplex working. Varley proposed, many years ago, another device, namely, to introduce at each end an inductive shunt; that is to say, to apply as a shunt a wire possessing both resistance and self-induction. But in spite of the use of condensers, of artificial cables, and of inductive shunts, the retardation of the long submarine cable has proved hitherto insuperable save for slow signals. In the sending of each signal the gutta-percha coating becomes charged, and this charge must be, as it were, swept out before the next signal can be sent. Retardation triumphs over the telephone and the automatic rapid telegraph.

And yet no reasonable electrician can doubt for a moment that ocean telephony must come, or that the resources of science are equal to the solution of the problem. It is because the author thinks that he has found the way to the solution that he ventures to place on record the ideas which have been growing in his mind for three years past, together with some of the evidence by which their soundness may be tested.

If the solution at which he has arrived seems strange to the ordinary telegraph electrician or cable engineer, it is because that solution has dawned upon him out of a different domain of science, namely from the study of alternate current phenomena. If the solution he now propounds seems impracticable to cable engineers accustomed to the old type of cable that has persisted now for 30 years, he would reply that it is the business of the engineer to make it practicable. If the business of the world demands a new type of cable then the engineer must be found who can manufacture and lay it. Seeing that such a cable, once laid, will (if the author's views are correct) perform the work at a rate that would at present require, say, 10 ordinary cables to perform, there is a very powerful inducement to the engineer to find a practicable way of realizing that which theory indicates as the submarine cable of the future.

II.—DEVICES TO NEUTRALIZE THE RETARDING EFFECTS OF CAPACITY IN SUBMARINE CABLES.

The retardation of signaling, which is found in submarine cables, is due to the capacity of the cable, and this capacity is distributed fairly uniformly along the cable. Owing to this circumstance, all attempts made hitherto to annul or compensate its operation by means of devices situated at the *ends* of the cable have met with very limited success, whereas, the ordinary speed of signaling through an Atlantic cable is about eight words or so per minute, it would be quite possible to send 400 words per minute through a line of the same resistance, but destitute of capacity.

The only effective way to annul the retarding effects of a *distributed* capacity is to apply a *distributed* remedy; that is to say, abandoning the idea of compensating it by devices placed at the ends of the cable, means must be sought for applying compensating devices *distributively* along the length of the cable, either at intervals or continuously.

It is well known that the effects of electro-magnetic induction are, in a sense, reciprocal to those of capacity. The most familiar modern example is that of the opposite operation of self-induction and of capacity on the phase of an alternate current, the one tending to produce a lag, the other a lead, in the phase of the current relatively to the electromotive force. It is obvious that if electrostatic capacity can be used to correct the effects of electro-magnetic induction, conversely it will be possible to use electro magnetic induction to correct the retarding effects of electrostatic capacity.

There are two main modes of action of electro-magnetic induction, namely, *mutual induction*, from wire to wire (with or without an iron core intervening, and sometimes called electro-dynamic induction), and *self-induction* when the current in a wire reacts inductively on itself. Both are known to be due to the setting up by currents of magnetic fields in their neighborhood.

There are a very large number of ways in which, theoretically, the end may be obtained of compensating the effect of the distributed capacity by means of distributive electro-magnetic induction. It will suffice here to consider two simple cases, and, for the sake of simplicity, it will be supposed that each is applied to the case of a cable containing two insulated wires for the outgoing and returning currents. Such a cable may be represented in Fig. 1, where A A is the outgoing wire or "line," and B B the incoming wire or return. In the subsequent figures the sheathing will not be specifically indicated.

FIG. 1.

CASE 1.—USE OF SELF-INDUCTION DEVICES DISTRIBUTIVELY.

In this case a series of self-induction coils of sufficiently high resistance and sufficiently great inductivity are placed across at intervals from the A conductor to the B conductor. In order the better to follow the action it will be convenient to represent the distributed capacity as in Fig. 2. Here the two conductors A_1 A_2, B_1 B_2, are drawn as though each in itself was devoid of capacity, but that a capacity was given to them in a distributive way by arranging a number of condensers along at intervals, each condenser having one coating joined to the A line, and the other coating joined to the B line.

Suppose the signaling to take place from the left hand end, and that a wave of current is being thrown into the circuit at A_1 by a transmitting apparatus joined to A_1 B_1. Were there no capacity or inductivity in the line A_1 A_2, the wave would travel simply along without retardation. But the presence of capacity changes all this. When the potential at A_1 is rising, the potential at some point along the line a would not rise simultaneously, because of the capacity in the intervening part of the conductor. The potential at a cannot rise to its proper value until the condenser between A_1 and a has received its charge. Similarly, the potential at c does not rise as soon as at a, because of the action of the capacity between c and a. Again, when the potential at A_1 is falling, it will not also fall at a or at c simultaneously, because the condensers in between tend to keep up the potential, and take time to empty themselves. Whenever the potential at any part of the line is rising, some of the current tends to flow into the condenser at that part, with the result that the rise of potential in that part is delayed, while the current beyond that part is for the moment smaller than the current that is coming up to the part. Further, when the potential at any part is falling there is a tendency for current to flow out of the condenser at that part, and thereby keep up the potential a little later; so that at that moment the current flowing away from the part in question is greater than that flowing towards the part. If nothing is done to compensate this action, the effect would be that virtually all the wave thrown into the cable at A_1 would be taken up in playing into and out of the successive condensers, and so only an insignificant and much retarded fraction of it would reach the end A_2.

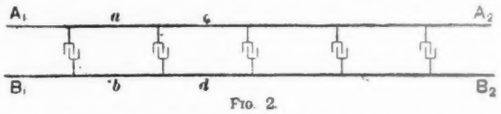


FIG. 2.

Now suppose that self-induction coils are placed across the cable at the proper intervals, as in Fig. 3. The operation of these coils in compensating the retarding effect of capacity is as follows: When the potential at a rises, current begins to flow through the self-inductive coil a b, and this current tends, by the well known inertia-like action of self-induction, to go on after the applied electromotive force producing it has begun to diminish, or has even stopped or reversed. Hence the current in the self-induction coil a b will attain its maximum value at a time after the potential at a has began to fall. It will by that very circumstance, as a consequence of the electro-magnetic momentum, tend to make the potential at a fall sooner than it otherwise would do. Hence the respective actions of the self-induction coil and of the condenser are of opposite kinds. One tends to cause the changes of potential in the line to occur later than they should occur; the other tends to cause the changes of potential to occur sooner than they otherwise would occur. Hence their action tends to compensate one another if applied at the same place. But the capacity of a line or cable is not at one place; it is distributed all along it; therefore, it is essential that the compensating devices should also be placed all long it, at sufficiently frequent intervals. It is well known that Varley employed an inductive shunt *at each end* of a cable; but this is not capable of compensating the capacity, except within, at most, a few score miles of the ends. The coils a b (Fig. 3) may be looked upon as compensating the capacity on both sides of it to a certain distance; the coil c d as compensating the capacity on both sides of it, and so forth. If all these compensators are properly ranged along the cable, then the total retarding effect of the distributed capacity will be practically annulled. The currents that run in and out of the transmitting end will be greater in quantity than those that are delivered in and out at the distant end, the difference being, of course, accounted for by the currents that flow across through the compensating coils. It will be seen that by the use of these devices, a certain fraction of the currents that are sent in at the transmitting end is, so to speak, used up on the way to pass through the compensating coils, and by their action prevent the retardation of the rest of the currents that are flowing down the line. To put the matter tersely, the compensators act as leaks across from the A line to the B line, which by their inductive action sweep out the accumulating charges that would otherwise retard the signals.

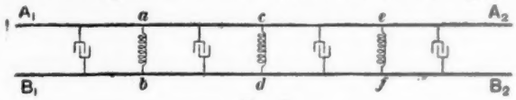


FIG. 3.

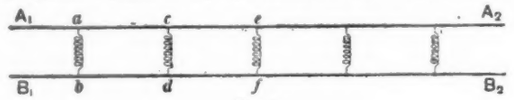


FIG. 4.

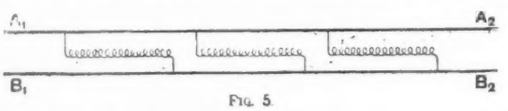


FIG. 5.

Some calculations on the magnitude of the currents that must thus flow across in the compensating coils have been made by the author, and some others for him by Dr. Sumpner. From these it appears that taking as a working basis the actual facts about cables as they are, and assuming a twin wire cable having a capacity of one-third microfarad, and a resistance of 10 ohms, for a mile length, also assuming that compensating coils are placed across at every 10 miles, if such coils have a coefficient of self-induction of 100 henries and a resistance of 3,000 ohms each (its time-constant being then about $\frac{1}{30}$ of a second), the rise and fall of current in each section will, with currents of the ordinary telephonic periodicity, be practically instantaneous in each section during the very small fraction of a second that the impulse lasts; and the value of the current from section to section will be practically determined solely by the shunting action of the successive compensators. Now, as telephonic currents may be shunted down to an extraordinary degree of tenuity, and yet be perceptible, it is evident that there are great possibilities opened out by this method of using the shunted portions of the current to neutralize the retardation.

The cable so constructed of two wires with compensating devices shunted across at intervals of 10, 20, or it may be 500 miles apart, will be represented diagrammatically by Fig. 4. The practical problem then remains, how to provide compensators having a sufficiently great time-constant without their constituting unwieldly enlargements of the cable. This is a very simple matter of construction. The author has tried several species of devices, some of them resembling elongated "hedgehog" trans-

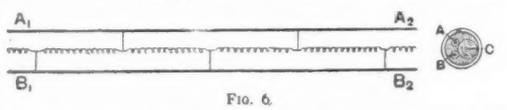


FIG. 6.

formers made very long and thin, and wound with one coil only of fine wire; others consisting of "shell" transformers elongated into a very long, narrow loop; others again consisting of simple iron wire, straight or looped, or of wire over-wound with a layer of iron wire. The self-induction, for example, of a one-millimetre iron wire, over-wound with a layer of iron wire three millimetres deep, is roughly about 0.1 henry per kilometre; and its resistance is 144 ohms. One point in favor of the use of loaded straight wires as self-induction devices is the circumstance that the compensator need not join two adjacent points in the two conductors within the cable, but may lie across, as in Fig. 5. This construction, which is specially suitable for cables of moderate length, resolves itself into a three-wire cable, of which one wire is loaded in some way to

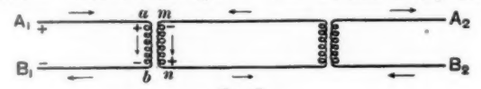


FIG. 7.

give it self-induction and resistance, and is connected at intervals alternately to the other two, as in Fig. 6.

As stated above, however, not only by self-induction, but by mutual induction, the retarding effects of capacity may be neutralized.

CASE 2.—USE OF MUTUAL INDUCTION DEVICES DISTRIBUTIVELY.

In this case the cable is considered in sections, each of which is an inductive relation with those on each side of it; and, again, there are many possible varieties included. One example is as follows: Let the two conductors along the cable be each divided into a number of equal lengths, and let the parts be joined together by mutual-induction coils, that is to say, by induction coils with two windings each. Though the exigencies of cable laying will necessitate some very

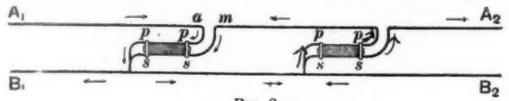


FIG. 8.

different shape of coil or device as an organ of mutual induction, we may assume these induction coils to be of the familiar form of an iron core surrounded by the two windings. The cable so made up of sections will be indicated by Fig. 7.

In this figure it is indicated that the coils are so connected that in the A line, when the current is increasing and flowing toward *a*, the inductive action will be causing a current in the next section, which will be at the same instant increasing, but flowing, so far as the A line is concerned, in the opposite sense, so that while the potential of the point *a* is rising that of the point *m* is falling. The consequence will be that the currents required to sweep out any accumulated charges due to capacity will not have to travel (as in ordinary cables) all the way from the ends of the cable, but need only travel short distances, never more than the

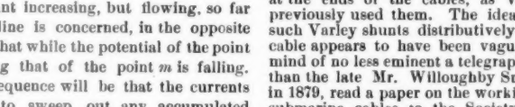


FIG 9

length of half a section. Hence, if a cable 2,000 miles long is cut up into 25 sections of 80 miles each, there should be no more retardation than on an ordinary cable 40 miles in length. It is not needful that both the lines should actually be divided; a virtual division into sections is effected in Fig. 8, where the B line is actually continuous. In this figure *p p* is the primary, and *s s* the secondary (or *vice versa*) of the mutual induction coil. Or the arrangement may be alternated, as in Fig. 9.

Or, again, if three conductors are employed—of which one may be the sheathing—the sectioning and use of mutual induction may be accomplished as shown in Fig. 10.

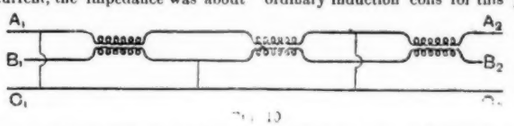
Here, again, as remarked above, the kind of induction coil which naturally suggests itself as suitable for the purpose in question is something of elongated shape, such as a very elongated loop "shell" transformer, or the "cable" transformer which was suggested for electric lighting purposes by Messrs. Siemens & Halske some years ago. Or, as the author suggested in 1891, by using a mutual induction between the wires of the cables themselves by merely enwrapping them, as they lie side by side, with iron. So that the cable once more becomes an arrangement of three parallel wires, of which two are specially brought into mutual inductive relations to one another, and are joined up at intervals, as indicated in Fig. 11.

Lastly; it is, as is well known, possible to have mutual induction between two wires that do not form part of closed circuits, as in the phonopore of Mr. Langdon Davies.

III.—EVIDENCE AS TO PRACTICABILITY OF USING INDUCTION DEVICES DISTRIBUTIVELY TO COMPENSATE RETARDATION.

With the facts already known that the Varley shunt does indeed operate at the ends of a cable to compensate in some measure the effects of capacity near those ends, and that on long land-lines the speed of signaling can be increased by inserting a translator in the middle, or even by a mere leak at some intermediate point, it is remarkable that no one should have suggested hitherto the very simple solutions now proposed. Perhaps the reason is to be found in the intense horror with which all good telegraph engineers regard the idea of having a fault on their line. Deliberately to insert, as the author proposes, a series of faults, as shunts across the cable from the going wire to the return wire, will, to many of them, appear sheer madness. The shunts are not mere faults, however. They are bridges possessing considerable resistance, and, what is more to the point, considerable self-induction. They are not leakages, through the insulation to the sheath, of an unknown amount, and one liable to increase by corrosion; they are as fixed and determinate as the resistance of the cable itself. Telegraph engineers have long known in general the virtues of an inductive shunt. In the third volume of the *Journal of the Society of Telegraph Engineers*, 1874, Mr. G. K. Winter describes the use of inductive resistances in cable signaling, such shunts being used at the ends of the cables, as Varley had previously used them. The idea of using such Varley shunts distributively along the cable appears to have been vaguely in the mind of no less eminent a telegraph engineer than the late Mr. Willoughby Smith, who, in 1879, read a paper on the working of long submarine cables to the Society of Telegraph Engineers. In this paper, after recounting some experiments made with Varley shunts—or what he seemed to think such—he adds: "I was under the impression that by a judicious distribution of electro-magnets on subterranean lines greater speed might be obtained." But he seems to have been deterred from following out the idea by finding that the solid core electro-magnets which he was using failed to operate favorably; and he even declared that such minute currents as were used in cable signaling were "totally inadequate to produce perceptible electro-magnetic induction effects." We now know from telephonic experience that this is not so, even the minutest telephonic currents being perceived, simply because they can produce sensible electro-magnetic effects.

Other electricians have proposed to use shunts containing electro-magnets from line to earth for various purposes, amongst them Mr. Lockwood and Mr. Edison. The latter, in his patent, No. 135,581, applies such shunts to overcome the static charge on lines. The author in 1884 proposed to apply such shunts to enable him to introduce a battery current into a telephone line without diverting the working telephonic currents. Again, it has been found in telephone work that a telephone receiver placed across from line to earth, as a shunt or bridge, does not prevent another receiver further down the line from receiving its proper current. This bridge method of arranging telephonic instruments has for years been used in the British Postal Telegraph service. In 1890 a most suggestive communication was made at the Detroit Convention of the American Association, by Mr. J. J. Carty, on "Bridging Bells," in which he described arrangements of way-lines in which the electro-magnets of the bells instead of being inserted in the lines (where their impedance would prevent telephonic talk), were set as bridges or shunts from line to earth. He found a way-line with eight such shunts upon it at eight intermediate stations to transmit speech better than it did with only two stations. In this case the coils used had resistances of 1,000 ohms, as measured on the Wheatstone bridge; but, with a magneto generator giving an alternate current, the impedance was about



10,000 ohms. Again, when in 1891 the London-Paris telephone line was constructed by Mr. Preece, with a special cable about 20 miles in length from Dover to Calais in the middle of it, the circuit being metallically closed, it was found that the talking from London to Paris was in no way interfered with when telephonic receivers were bridged across the circuit at the two ends of the cable. In fact, such bridging rather improved the working of the line. It is, therefore, reasonable to suppose that by systematizing the arrangements, of which more or less imperfect glimpses are afforded in these instances, and by providing a cable with inductive shunts at proper intervals all along, so as to balance the capacity from point to point in a distributive manner, the longest cable can be made to transmit speech, and if speech, the less frequent impulses of automatic telegraphs.

Many experiments have been made in the author's laboratory with arrangements of apparatus set up to imitate by condensers and resistances the retarding properties of

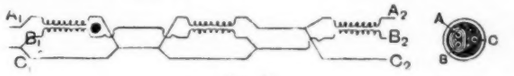


FIG 11.

actual cables. An example will suffice. A section of artificial cable was made up of a resistance of 7,000 ohms, and a capacity across between line and earth of 10 microfarads. Through this cable not a sound could be transmitted telephonically to a double pole Bell receiver at the distant end, either with a Blake transmitter (with induction coil) or with a Hunning's transmitter without induction coil. When, however, a single compensating self induction coil, having a resistance of only 312 ohms, and a time constant of about 0.005 second, was bridged across at an intermediate point, telephonic transmission became at once possible, save for very shrill sounds.

One curious result came out in one of the series of experiments, namely, that those telephonic transmitters which have induction coils in them (the ordinary mutual induction coils with thick and thin winding) are almost useless for the purpose of cable transmission. Apparently the fine wire winding has too great a self induction in series in the circuit to be suitable for this purpose. At any rate, better results were obtained from transmitters of other types. Quite recently the author has got better results from a transmitter in which the ordinary two wire mutual induction coil was replaced by a single self induction coil on a plan suggested by him in 1884. It is obvious that any plan which contemplates the counterbalancing of retardation by shunting (through self induction coils), a notable fraction of the current may necessitate a new type of transmitter, capable of sending telephonic currents of much greater amperage than those ordinarily used in overland telephony.

So far, the evidence for the effective operation of self induction has been considered. But there exists also much evidence to show that mutual induction by devices properly distributed along a twin wire cable will also be effective in neutralizing the retardation due to distributed capacity. It is an old and well established rule that the retardation in a cable is proportional to the square of its length. If one could cut a 2,000 mile cable into two cables of 1,000 miles each, and simply translate or relay the current from one into the other, the retardation of the whole ought to be reduced very materially; perhaps not to one-quarter, but at least to one-half. Only here, again, it is evident that some of the electric energy supplied at one end must be used up in the act of working the translator or relay, however it is constructed, even if it be only a simple mutual induction coil. Therefore, if a cable is cut up into numerous sections, each connected by mutual induction with the next, a considerable fraction of the energy put in at one end may never reach the other, being spent on the road in overcoming the retardations that would otherwise arise. For land lines it has often been proposed to cut up the line into parts, as, for example, by Edison in his patent No. 150,848, in which, for the attaining of greater speed, he shows a line divided at three intermediate points where the circuit is grounded through mutual induction coils. The objection to ordinary induction coils for this purpose is that they are never well enough made from the inductive point of view. If they are not so constructed that *all* the magnetic flux due to one of the sets of coils interlinks itself with the other coil, then each coil will possess an unbalanced self induction, and will offer an impedance. Mutual induction, as is well known, tends always to wipe out the self-induction of both the circuits thus brought together; but with the most perfect conditions of magnetic circuit, the utmost that the mutual induction can effect is to neutralize the self-induction only of those coils which are acting as mutual inductors. It cannot neutralize the self-induction in parts of the circuit beyond. Hence, for the particular purpose in question—namely, that of enabling the circuit to transmit telephonic signals—the induction devices must not be simple ordinary coils inserted haphazard at intervals; they must be specially designed, and inserted with perfect regularity. And the cable itself must be freed as far as possible from self induction. *Never, for such a purpose, must a cable be constructed, as Atlantic cables have hitherto been, of a single conductor* (of stranded copper) *surrounded by an iron sheathing* that comes in between the outgoing and the returning parts of the circuit, thus adding an enormous impedance. Happily, in all twin cables, where outgoing and returning conductors lie side by side within the sheath, the iron of the sheath, inclosing both, increases the mutual induction between them. As the author pointed out in 1890, in the discussion on the London-Paris telephone line, the mutual induction of the twin cable is a positive gain, enabling transmission to take place far beyond the limits previously assigned, from considerations as to capacity and resistance alone. In such constructions as Fig. 6 the iron used to increase the self-induction of the wires that act as compensators will of itself increase the mutual induction between the twin conductors if they are properly disposed. The experience gained with alternate current working is absolutely conclusive as to the efficient action that may be expected in special constructions for future ocean telephony.

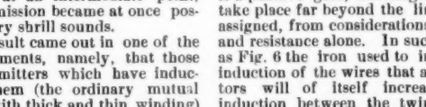


FIG. 12

IV.—CONCLUSION.

Ocean telephony is possible. The means for attaining it are within our grasp. Compensated cables of the new type are entirely practicable. It may be needful to begin with some shorter line than an Atlantic cable, in order to gain experience. But an Atlantic cable constructed on the new plan will not cost much more, when laid, than one of the old type; and whether or not it is successful in conveying telephonic speech, it will certainly transmit telegraphic messages at a greatly accelerated speed of signaling. If one Atlantic cable can be constructed to do the work now requiring eight cables, that cable will be constructed. Acceleration of the ocean telegraphic service is in itself a desirable step in advance; but the advance will not be complete until telephonic speech is transmitted also from shore to shore.

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Last week's cyclone was especially destructive in this vicinity to overhead electric construction. The telegraph wires suffered the most. The Western Union connections between the East and South were cut off for many hours.

Our interesting account of the electric lighting of the Ferris Wheel at the World's Fair brought forth many compliments and created an unusual demand for last week's ELECTRICAL REVIEW. We have received a large number of letters stating that our illustration of the Ferris Wheel is the finest that has yet appeared.

We understand that the Manhattan Railway Company is proceeding to secure plans for the electrical equipment of its elevated railways in this city. The final plans will not be submitted for six or seven months, but the method recommended will be the overhead trolley system, unless something better is developed in the meantime.

The London *Electrical Review* says "the fictionist has nothing to do with science, and in so far as he approaches it, he degrades it." This in criticism of an article in the *Engineering Magazine*, by Dr. F. A. C. Perrine, entitled, "Electricity in the home and office," a fancy sketch of an evening spent with a very wealthy man whose home is a maze of electrical conveniences. Our esteemed contemporary contends that "weak Jules Verneian vaporings deserve no encouragement—least of all from a journal presumably concerned with the solid technology of engineering." What a narrow view of things! Does our namesake expect people to live on roast beef all the time and every time? Can't we have just a little dessert and sweetmeats now and then?

THE ELECTRICAL CONGRESS.

We present in this issue a graphic, comprehensive, and yet concise report of the proceedings of the World's Fair International Congress of Electricians, held at the Art Institute, Chicago, from Monday to Friday of last week.

The attendance was very good, about 300 American and foreign electricians being in attendance. The papers, some of them, were quite interesting, that of Prof. Sylvanus P. Thompson on "Ocean Telephony," which we print in full, being especially so, and eliciting considerable discussion.

No doubt some good was accomplished by the personal meeting of eminent electricians from all parts of the world, but as for the scientific value of the Congress so much may not be said. Our opinion is that there was too much red tape about the whole meeting, and the idea of dividing the Congress into sections, meeting in different places at the same time was a bad blunder, making it impossible for one to secure even a general idea of the Congress as a whole. The uncomfortable place of meeting was a great drawback, and the officiousness and inefficiency of some of the small men suddenly called on to exercise authority must have belittled us in the eyes of our distinguished foreign visitors.

The past week was marked by two heavy failures in the electrical and allied industries, those of the Ansonia Electric Company and Wallace & Sons. Various reasons for these suspensions are given, but the general hard times of the past few months are doubtless chiefly responsible.

The electrical inspectors of the boards of fire underwriters don't like people to run motors and lights from 500 volt street railway circuits, and have made a strict rule prohibiting the practice. We fear there are some people who will object heartily to any such rule.

An unknown Boston paper published a sensational attack on the General Electric Company recently. When the marked copies reached New York the price of the stock went up five points. Another proof of the influence of the press—particularly of that portion of the press only twenty-three days old.

Mr. J. C. Anderson, of Chicago, referring to the ELECTRICAL REVIEW's article on the Patent Office, endorses every word of it, and it ought to be engrossed and hung in the office of every inventor and manufacturer in this country. He feels that the treatment of the Patent Office Department by the government is an outrage.

"Electrocution" is claimed by the word sharps to be a monstrosity in word building. The New York *Recorder* avers that "electrocast" would be the best verbal expression of what happens to a man who has been killed by a current of electricity. This will do for accidental deaths, but there should be no word to describe the killing of criminals by electricity. The law should be repealed.

Last week Mayor Gilroy received a communication from Edward B. Ives, an electrical engineer employed by the Philadelphia Electric Traction Company. In it he stated that he could easily refute the Manhattan Railway Company's claim that it cannot accept the Rapid Transit Commissioner's proposition because of the financial depression. According to Mr. Ives, his own company finds the hard times a benefit, because labor, labor saving devices and iron are cheaper than they have been at any time heretofore. His company, he states, is making plans to spend millions in street railways. Electric railway builders may see some practical pointers in this advice.

LETTERS FROM A LABORATORY.—LX.

BY JULIAN A. MOSES.

The recording of progressive operations by means of curves has done much to simplify their ready understanding, and the graphical way, by means of co-ordinate paper, has been of the greatest use in order to give a comprehensive impression at a glance. In a series of experiments it becomes a necessity to keep an unalterable record, and when such is the case, the co-ordinate paper, which may be purchased at any draughtman's supply store, answers all purposes. But for lecture purposes, where ocular demonstrations on a large scale are desired, either charts or lantern slides must be resorted to. Charts are often difficult to manipulate, where lantern slides, if a projector lantern be handy, are very convenient. They occupy practically little room, and are therefore easier of transportation, this latter being very difficult in the case of charts, as any one who has ever had occasion to carry around a set, is well aware.

A good method for obtaining curves in a simple and satisfactory manner has been found to be as follows:

A large opaque glass "slate" should be made, say, about 20 inches square. This may be ground with fine sea sand or emery, employing any suitable rubber; or the glass may be purchased already ground, it being manufactured for memorandum slate purposes. Set this flush in a wooden frame and divide it off into, say, 10,000 squares, 100 divisions on both the y and x axes.

This dividing should be carefully done, and each tenth division should be emphasized by a darker line. For marking purposes a steel tool soon becomes dull, while a diamond will not give more than a mere scratch, which renders the "slate" susceptible of fracture upon the least jar. Writing upon it may be done by employing the tool devised and patented by Dr. Phelps, which consists of a platinum wire bent around the end of a slate pencil, fastened in a handle, through which passes a stream of water to cool the metal sheath. The conductors, to which is fastened the platinum wire, run through this casing and permit of the passage of a current sufficient to heat the platinum to a white heat. The tool is used as a pencil, and as the white hot wire passes over the glass it leaves a little furrow into which may be put any suitable coloring material. If a very elegant "slate" is desired, these lines may be filled with black and red enamel, but for all ordinary purposes Brunswick black may be used, applying it to the lines with a camel's hair pencil, allowing it to dry, and scraping off with a knife, or rubbing off with a cloth slightly moistened with benzine, all superfluous material. The numbers may be added in the same way.

If the slate is of sufficient fineness of grain, the slightest pencil mark will be observed. All construction lines may be made in pencil and the final curve drawn with india ink. The former may be readily erased by means of the finger or a cloth slightly moistened with water, and the heavy india ink curve left untouched. This gives a decided contrast and as soon as a photograph is taken, the curve may be erased with a wetted cloth and the "slate" is ready for the next drawing, the squares, of course, remaining intact. In the photograph, a convenient size being about five inches square, the curve comes out black, but if a white line on a black background is desired black glass may be used for the slate, using white lead as the filler for the lines and numbers.

This process may seem complicated, but for lantern slide work it will give excellent results.

The time required for taking the photographs is not long, for within an hour after the slate was photographed I have obtained a positive on bromide paper mounted ready for binding.

Where a number of tests are made it will be found advisable to bind these papers so as to give a complete record of a series.

A very elegant book may be made by using transferotype paper, placing the films upon transparent zylonite.

One trouble with this method, however, is that unless the zylonite be of sufficient thickness to withstand the contracting power of the gelatine or collodion film, buckling will ensue, which will cause the plates to roll up.

A cover may be made of zylonite in imitation of ivory, and the whole book will present a very neat and solid appearance.

Advertisements may be produced by this method, and while they are attractive they possess the additional advantage of cheapness; the inscriptions, however, may be made by printing by any of the many photo-lithographic processes.

CORRESPONDENCE.

OUR BOSTON LETTER.

Invitations to the Annual Clam Bake of the American Electrical Works of Providence, R. I., have just come to hand. This outing is always looked forward to with much pleasure by electrical men of Boston, and the party which will leave this city on the morning of September 2 will be a guarantee of the esteem in which the genial president of the Providence concern is held.

At the last annual meeting of the stockholders of the Bradbury-Stone Electric Storage Co., held recently in Portland, Me., the following officers were elected: President, C. E. Adams; clerk, P. J. Larrabee; secretary, F. J. Stone; treasurer, O. B. Raulett; directors, O. B. Raulett, F. J Stone, C. E. Adams, H. W. Morton, J. G. Bradbury, F. W. Puffer, E. S. Foss, S. K. Dexter, and E. W. Lovejoy. It was voted to authorize the purchase of the property and rights of the Bradbury Stone Storage Battery Co., of Kittery, Me., the Bradbury-Stone Storage Battery Co., western, at East St. Louis, Ill., and the B. & S. Storage Battery Co., Sioux City, Ia.

Inability to make collections has forced Wallace & Sons, of Ansonia, Conn., to suspend, and their affairs have been placed in the hands of receivers. They were one of the oldest and best known manufacturers of brass and copper goods in the country, and were perfectly solvent, their assets being about $2,000,000, against liabilities of $874,000. Their rolling mills, wire mills and factories at Ansonia are the largest industry in the town, and furnish employment to 1,400 men. The immediate cause of their failure was their inability to meet a note of $25,000 which fell due on the 22d, although their book accounts, which are supposed to be good, amount to $600,000. Thomas Wallace, of Ansonia, Conn., the treasurer of the concern, and R. M. Thompson, president of the Oxford Copper Company, have been appointed receivers.

The Announcement of the Beacon Vacuum Pump and Electrical Company in relation to their "New Beacon" incandescent lamp, which appeared in the columns of the REVIEW last week, has created a great amount of interest among the trade, and their attitude toward other manufacturers, in voluntarily offering them the privilege of manufacturing with certain equities is at present the chief topic of discussion. Having heard considerable speculation as to the feasibility of such an arrangement being carried out, and as manufacturers are not fully informed as to what changes in their plants would be necessary to enable them to manufacture lamps under the process used by the Beacon Company, I sought an interview with Mr. Henry S. Kaliske, general manager of the Beacon Company, for the purpose of ascertaining for the benefit of our readers just how matters stood. Mr. Kaliske had no hesitation in giving me all the facts of the case, and stated among other things that he had already received several inquiries from lamp manufacturers on the same subject, and applications for the privilege of manufacturing under royalty, if such arrangements could be made. Mr. Kaliske desired it distinctly understood that no changes whatever were necessary in any plant heretofore devoted to the manufacture of incandescent lamps, to enable them to turn out the "New Beacon" at a less cost, royalty added, than was possible in the old type of lamps of whatever make. He went a step further, and stated that several expensive departments could be dispensed with altogether, thus enabling them not only to save expense and valuable space, but to get a greater output from the same facilities. Glass blowing, with the exception of the simple processes of "tubulating" and "forking," is entirely eliminated, and as there is no platinum used in the construction of the new lamp, it is obviously cheaper to manufacture. Another important point is that the usual leaks in the neck of lamps, due to imperfect fusion of the glass, is entirely done away with by the use of the cement, which makes it absolutely air-tight. Some of the material used in the manufacture of the new lamp would be furnished licensed companies at a nominal cost, and the royalty will be five cents per lamp, which is the same as the Beacon Company are paying the inventors for those turned out by them. They are enabled to offer these favorable terms from the fact that their agreement with the inventors specifies that they will have an equity in such contracts. The returns from the lamp already have proved most satisfactory, and orders for large quantities are received daily. A branch office has been opened at 39 Cortlandt street, New York, which is in charge of James T. Hanbay, one of the directors of the Beacon Company, and for many years prominently identified with the Westinghouse interests at Pittsburgh.

The Present Condition of affairs in financial and business circles in this city is bad; worse, in fact, than the majority of the business men of the present day have ever known it to be. How long it can and will last, and what measures should be adopted for immediate relief are the questions of the hour, and with a view of obtaining some information on these points, and to gather, if possible, the general feeling of the trade as to the outlook for fall business, I have seen and talked with a large number of prominent electrical men in this section during the past week. That matters are now as bad as they well can be is their unanimous opinion, and many hold that the bottom of the decline has been reached, and that any further tendency must be toward a recovery. How soon this improvement may be looked for is, of course, a matter of speculation, chiefly, but September holds great promise to expectant eyes. The dilatory action of Congress at a time like this, when the entire country is looking to them for immediate relief, is roundly condemned on all sides, and here, as elsewhere, the business men and State Board of Trade have taken the matter up, and resolutions and petitions will soon be presented to that body, in the nature of a demand too strong to be ignored. Deep down in the minds of many, and not to be uprooted by all the agitation of the silver question, is the firm belief that the primary cause of all the trouble lies in the uncertainty and distrust as to what action will be taken in regard to the tariff. The financial stringency is probably only temporary, there being no actual scarcity of money, and sooner or later would pass away with or without any action on the part of Congress—sooner without than with unless very different tactics than the present are adopted—as public confidence becomes gradually restored. A straightforward and positive declaration on the part of Congress as to what action will be taken in regard to the tariff is of vital importance. The time at which any changes will go into effect is of greater importance to the manufacturing and importing interests of the country than the nature of the changes themselves, whatever they may be, as with this understood, manufacturers could lay their plans ahead, and adjust their business accordingly. When it is taken into consideration that, during the past two months, 1,000,000 men have been thrown out of employment, that manufactories of every kind are either closed entirely or running half time with a greatly reduced force, it is not hard to believe that something more important than the silver question alone is at the bottom of it. One of the largest manufacturers in New England, whose mills are closed, and his 2,500 men idle, told me that if he was assured there would be no change in the tariff for the next two years, he would run his mills day and night and take his chances. This is only one case of many, and serves to illustrate the general feeling. The electrical trade as a whole has borne the shock of the financial earthquake bravely, and is looking forward to a good fall season with the utmost confidence. Large contracts for construction and equipments of all kinds are ready to be placed, and only waiting for a little better financial conditions. Money is coming in in larger quantities, confidence is being gradually restored, and if Congress would stop talking and get to work, as the people expect and demand, the result would soon be apparent. This is no time for idle lamentation, and the American people are not the ones to indulge in it. They know pretty nearly what they want, and at present they demand of Congress two things—the unconditional repeal of the silver purchase clause, and to let the tariff alone. This demand is daily gathering strength and weight, and the sooner Congress dispenses with political stockjobbing and gives heed to it the better it will be for all concerned.

Boston, August 26. H. G. T.

We are pleased to learn of the increasing attendance at the World's Fair, and desire to urge every one of our readers who has not done so to visit this grand exhibition at the earliest opportunity.

On September 6, unless satisfactory arrangements can be made, the plant of the Woburn, Mass., Electric Light Company will be sold by auction to satisfy a mortgage for $35,000 held by Dr. John H. Harlow of that place. The amount required to be paid down at the time of sale is $3,000.

Christian Science applied to financial situation is *apropos* about now. According to that cult, there is no disease; you only think you've broken your leg. Make up your mind it's all right. Transposing this reasoning, you are not broke in purse; you only think you are. At any rate, talk as cheerfully as may be about money matters and you will assist in restoring that confidence upon which the prosperity of this great republic so largely depends.

A Demand for Patent Office Examiners.

U. S. CIVIL SERVICE COMMISSION,
WASHINGTON, D. C., August 24.

TO THE EDITOR OF ELECTRICAL REVIEW:

There is a demand for more fourth assistant examiners in the Patent Office than the Civil Service Commission is able to supply, and the Commission, therefore, desires to make known this fact to as many students in colleges and other competent persons as possible.

The position is considered a very desirable one, and can be filled only by those who have an advanced education in the sciences.

The subjects of the examination are: Physics, technics, mathematics and chemistry and mechanical drawings. A pamphlet containing sample questions, and also containing the dates and places at which examinations may be taken, will be furnished to those who desire to become applicants. In addition to the regular dates and places of examinations, as given in the schedule, the Commission will arrange to give the examination on September 7, in Boston, New York, Philadelphia, Detroit, Chicago, St. Louis and Omaha, if there are applicants for these places.

The salary of the position is $1,200 per annum.

This circular will be sent to the various colleges and scientific journals of the country, in the hope that information may be given to students and others who may be interested to apply.

Requests for application blanks and for the pamphlet of instructions should be addressed to the United States Civil Service Commission, Washington, D. C.

Very respectfully,
CHAS. LYMAN, President.

PERSONAL.

Gen. E. S. Greeley, of the E. S. Greeley & Company, is away on his vacation, and will be absent several weeks.

Mr. Lemuel Porter, M. E., consulting engineer for the Malden Machine Company, Providence, R. I., favored the ELECTRICAL REVIEW with a call last week.

Mr. Robert M. Jones, of Salt Lake City, Utah, has recently obtained from the municipal authorities a valuable franchise for lighting the city by electricity. Mr. Jones is the inventor of an electric motor for rotary drilling machines that promises to have a particular value in its field.

Mr. Henry Hine, general manager of the Stanley Electric Manufacturing Company, of Pittsfield, Mass., spent several days in the metropolis last week looking after the business of his company. The demand for the apparatus of this company, particularly the Stanley transformers, continues very large, notwithstanding the money stringency.

Mr. J. W. Dickerson will hereafter be associated with Mr. Edward Caldwell in the editorial management of the *Street Railway Gazette*. Mr. Dickerson is an experienced newspaper man, and is well known as a writer on street railway and electrical subjects, having been connected at different times with the editorial staff of the *Street Railway Journal*, the *Western Electrician* and *Electricity*.

Mr. W. D. Sargent, the eminent telephonite of Brooklyn, was lost to the world for several days recently. In company with Mr. A. W. Daus, the architect, Mr. Sargent started off on a pilot boat from New York, expecting to be gone three or four days. Not meeting many incoming steamers, it was eight days before they were able to get back. The trip was a novel one, and notwithstanding slight attacks of *mal de mer*, both gentlemen hugely enjoyed the outing and returned with youth restored.

Mr. Clarence E. Stump, formerly vice-president of the Street Railway Publishing Company and business manager of the *Street Railway Journal*, has associated himself with the *Street Railway Gazette* as its president and general manager, and will in future devote his entire time and attention to the business department of that paper. The *Gazette* is to be heartily congratulated, as Mr. Stump's wide acquaintance, together with his experience as a newspaper man and as business manager of the *Electrical World* and *Street Railway Journal*, make him especially valuable.

Wall Street and the Electrical Stock Market.

A review of the speculation in Wall street during the past week fails to develop any special points of interest. The stock market opened strong on the receipt of better news from Washington, declined in expectation of a large failure in Wall street and resumed its advance when this failure was averted. Business in stocks has been very dull.

The movements in bonds have been irregular. Edison Electric Illuminating Company, of New York, fives declined four points, and General Electric fives declined one-half point.

The Lynn, Mass., *Press* says that rumors of all sorts are rife regarding the General Electric Company. While it is generally believed that the company will weather the storm—for no amount of contradiction on the part of the officials will convince the people that they are not sailing on a very troubled financial sea—there must be some foundations, be it ever so small, for all the rumors.

The Boston *News Bureau* reports a sagacious capitalist as observing: "I wonder what we are getting at in this mad destruction of credit. Must our machinery of credit exchange of commodities stop? The General Electric Company is forced into partial suspension of its labor and factory operations, not because of the falling off in any department of the electrical field for its machines and supplies, but because it has not the credit to-day that either the old Edison or the old Thomson-Houston had locally when they were rivals and cutting each others' throats before the consolidation."

A Boston dispatch says that the General Electric Company has this week received $800,000 (absolutely new money), or 20 per cent. of the amount which the underwriters of the new subscription stand pledged to furnish the General Electric Company at any time, pending the completion of the subscription which it is proposed to offer to stockholders.

The next dividend on General Electric preferred is not due until January 1.

There was much discussion on State street, in Boston, one day last week over the fact that the same parties who sold General Electric preferred down to 44 were bidding 59 for it at the close.

New York, August 26.

The Cow and the Milkmaid.

TO THE EDITOR OF ELECTRICAL REVIEW:

I noticed in your issue of August 19 the question asked regarding the "Cow and the Milkmaid," and also your reference to the drawings illustrating my patent, No. 500,828, of July 4, which, as you say, represented a dress shield.

Although the above was designed simply as a "lightning arrester" for series arc circuits, yet, nevertheless, it could probably be used as you say, but would likely be of more benefit to mankind if used as an "electro-medical appliance" to be carried in the pocket as an absolute preventive of cholera, gout, lumbago, sore throat, etc.!

As regards the late Patent Office delays, my ideas exactly coincide with yours in that this important work should go on speedily, irrespective of party differences, and that only experienced help should be employed. Hoping that future drawings will be much more intelligible, I remain,

Sincerely yours,
WM. A. TURBAYNE,

Detroit, August 21.

The Ansonia Electric Company Fails.

As was expected, the embarrassment of Wallace & Sons precipitated the failure of the Ansonia Electric Company, of Ansonia, Conn., and Chicago. On August 26 John B. Wallace, the president, was appointed receiver for Connecticut, and John B. Waller, his brother-in-law, of Chicago, receiver for Illinois. Both have qualified. The company employed 125 hands at Ansonia, and 75 in Chicago. The liabilities are given as $300,000, and the assets much greater. The company is the outgrowth of the firm of Wallace & Sons, which suspended on August 23, and depended on them for supplies. The stock is held almost entirely by the Wallace family. Wallace & Sons expect to resume under the receivership September 4.

The Brown & Sharpe Exhibit at the World's Fair.

The extensive exhibit of the Brown & Sharpe Manufacturing Company, of Providence, has attracted favorable comment from all World's Fair visitors interested in this line of manufacture. Forty machines are shown, and there is a fine display of small tools and those of Darling, Brown & Sharpe. The company announces that the exhibit fairly represents the growth of its business, five of the machines never having been shown before, 12 new since 1889—the date of the Paris Exposition, where the company received the highest award—and 11 others having been radically remodeled.

Milling machines are perhaps the most conspicuous of the machine tools in the exhibit, as there are 16 different kinds and sizes. Among them are shown the original universal milling machine, patented in 1867 by Mr. Jos. R. Brown, and the five milling machines which are new in design, and were not publicly shown before the opening of the Exposition. Other prominent machine tools in the exhibit are the universal grinding machines and the automatic gear cutting machines.

The display of small tools is quite complete, there being, in all, more than 1,500 without duplicates. Among those which receive the most attention are the formed cutters, the gear and milling cutters, the micrometer calipers and the various varieties of standard gauges. There are also a number of samples of work shown that are in finish just as they were left by the machines. The small tools and machine tools, except the original milling machine, are the same in finish and design as those the company regularly manufactures and usually has in stock.

An interesting and well illustrated pamphlet, illustrating the exhibit, has been published by the company, and will be sent on application.

The methods which this company employs in manufacturing contribute largely to the accuracy, which is, perhaps, the chief merit of the tools. These methods are sometimes called the American methods, and include the use of special fixtures and limit gauges, the manufacture of a great many parts at once, and a thorough system of inspection. The officials are always glad to explain these methods to visitors.

The buildings at Providence are said to be the best in America for this line of business, and they are exceptionally neat structures, modern in every particular, and planned especially to assist in manufacturing conveniently and economically. The machine shops are fire-proof. In size the buildings exceed four and a-half acres. To walk through them requires an hour and a half. To see them with any degree of thoroughness will occupy a day and a half. They comprise a most interesting and impressive example of successful American manufacture.

TELEPHONE CHAT.

The American Telephone and Telegraph Company is asking right-of-way through Clay County, Ind.

The output of the American Bell Telephone Company for the month ending August 20 is as follows:

	1893.	1892.	Inc.	Dec.
Gross output.	4,161	7,316	....	3,155
Returned ...	6,596	5,806	790	....
Net, def.....	2,435	1,510	....	3,945
Since Dec. 20:				
Gross	63,627	65,219	....	1,592
Returned	39,348	34,482	4,866	....
Net	24,279	30,737	....	6,458

All the managers and superintendents of the offices of the Southern New England Telephone Company held their annual meeting and outing at New Haven, Conn., last week. In the morning there was an informal meeting at which business was discussed. In the afternoon the guests, to the number of about 25, adjourned to Hill's Homestead, where a bounteous repast was served. In the evening a theatre party was made up, and the performance of "She" was witnessed. General Superintendent E. B. Baker acted as host during the day.

Architect L. W. Robinson has completed plans for a new building to be erected in Waterbury, Conn., for the Southern New England Telephone Company. The building will be erected on Bank street, and will be two stories high, with a cellar and attic. It will be of brick, with stone foundations and with belt courses of molded brick across the front. The front windows are to have jambs formed of molded bricks. It will have a 30 foot front and will be 72 feet deep. The first story will be occupied by a store. The second story will contain the manager's office and ladies' parlor in the front of the building and the operating room in the rear. This room will have a floor space of 28x40 feet.

En Route to the Congress.

THE STOP OF THE EASTERN DELEGATES TO THE CONGRESS AT NIAGARA FALLS.

Our little party stopped over at Niagara Falls, Sunday, August 20, where we accepted the hospitality of Mr. W. A. Grant, the manager of the Niagara Falls Park and River Railroad. This road is a splendid means of saving the many charges which meet one at almost every turn. It being on the Canadian side, a very satisfactory way of seeing all the points of interest is afforded. It runs along the bank of the river from Queenston to Chippewa, where an almost entirely uninterrupted view of the Falls, rapids, whirlpool and river generally, may be obtained. Comfortable observation cars are run, and the power house, situated midway between Chippewa and Niagara Falls, is, as Prof. Jamieson aptly describes, "the neatest and cleanest he has ever seen." This gives us a little hint concerning the power stations in England, and our American pride may well be satisfied. Prof. Jamieson, by the way, is a most interesting talker, a typical Englishman, and this being his first visit here, it can readily be imagined how we listen to and appreciate a conscientious statement of an intelligent and unbiased foreigner's impressions of the electrical push and progress of this country.

It seems remarkable that the banks of the river have not, before the present time, been occupied by a railroad company. The trolley, however, makes the transportation a pleasure, for in but half a day everything may be seen. Not more than 15 years ago it required the expenditure of about $13 in order to see the wonders of the Falls. Now, a round trip on the cars, a distance of nearly 25 miles, may be had for the extremely moderate price of 50 cents. It is to be hoped that as public benefactors this company will have so much traffic over their line that they will benefit their treasury as much as they deserve; for not only do they make money for themselves, but they save it for others, and the saving is so obvious that it would seem, as soon as its existence is well known, the poorer man will have a chance of seeing these Falls, one of the greatest of Nature's grandeurs. Let their motto be: Half a day for half a dollar. In order to get to the electric railroad from Niagara we have to pass over one of the bridges, on which the toll is 25 cents over and return. When it is noticed that the traffic over this bridge amounts to quite a number, it is impossible to ascertain the exact number, but it would not be too great an estimate to say that about one person a minute, it will be seen that its receipts are quite considerable.

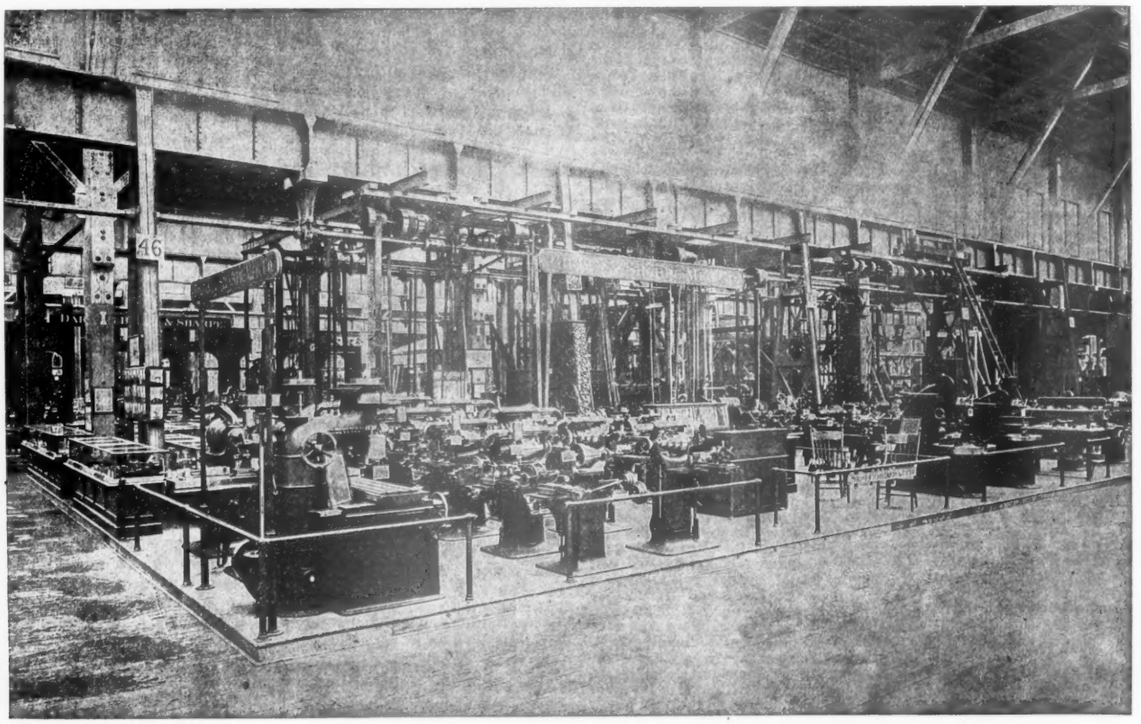
After we have returned from our pleasant trip we ride to our hotel. Mr. Charles R. Huntley, ex-president of the National Electric Light Association, greets us. His presence causes a number of exclamations of surprise, but we manage to reach our train in safety, and I now write this while we are passing through the Dominion of Canada, to the accompaniment of volleys of logarithmic and other formulæ being indulged in by Messrs. Mailloux and Steinmetz.

J. A. M.

ELECTRIC LIGHT FLASHES.

The General Electric Company has taken the contract to furnish Dannemora Prison with a new electric light plant to be in operation by October 1.

It is announced with some degree of surprise that the electric light has been introduced into a new flour mill near the supposed site of Calvary and close to the Damascus Gate at Jerusalem. Nothing surprising about that. Did not the Lord say "Let there be light?"—*Butte, Mont., Miner.*



WORLD'S FAIR EXHIBIT OF THE BROWN & SHARPE MANUFACTURING COMPANY, OF PROVIDENCE, R. I.

The commissioner and Warden Allen have finally concluded to reject all bids for the new electric light plant at the penitentiary in Joliet, Ill., but what steps they will now take they have not fully decided. At their next meeting they will discuss the matter and arrange to have more satisfactory bids made.

The arbitrators appointed several months ago to fix the price to be paid to the Narragansett Electric Lighting Company by the city of Providence for lighting the city's streets by electricity have concluded their labors, and hereafter the city will pay 38½ cents per night for each electric arc light furnished by the company.

The Oyster Bay, N. Y., Electric Light and Power Company's plant has long been inadequate to the demands made upon it, and no one realized this fact more than the company itself. The company has been in prosperous condition and the stock has paid good dividends, but no action has been taken, although promises of better service have repeatedly been made, until now the company is preparing to increase its plant by the addition of an incandescent light dynamo and steam power.

THE WORLD'S FAIR.

EDISON "INCOG" AT THE FAIR — HIS FRIENDS LOSE HIM—ATTENDANCE INCREASING—THE AMERICAN BELL TELEPHONE COMPANY'S EXHIBIT—THE GENERAL ELECTRIC COMPANY.

Thomas A. Edison, accompanied by his family, arrived in Chicago last Monday evening, and went immediately to a house on Lake avenue, in the southern part of the city, where he will live while he is here. Mr. Edison is visiting the Fair *incog.*, and his coming was unsuspected, except by a very few. He will be here only two weeks, and as yet has not visited Electricity Building, and says he has no intention of going there. Mr. Edison's object in coming to the Fair *incog.* is to avoid the people who want to show him things he doesn't want to see. He wants recreation, and is determined to see the Fair as a private citizen at his ease. He brought along with him a lot of his big black cigars, and is having lots of fun, mostly by himself.

Mr. Edison told the editor of the ELECTRICAL REVIEW several months ago that he had given up experimenting in electricity, and would henceforth devote himself to chemistry, metallurgy and his magnetic ore separator. Consequently, the first thing he did at the Fair was to visit the Mines and Mining Building, which he went over thoroughly.

Mr. Edison thinks that no man who makes his living by his intellect can afford to stay away from the Fair, and says the White City is wonderful and amazing to him in its grandeur.

On Wednesday some of Mr. Edison's friends thought he was lost, and rushed off post haste to Professor Barrett's office for assistance in finding him. Chief Barrett, Dr. Hornsby and a lot of General Electric officials organized search parties, and all started intuitively for the Midway Plaisance. But he wasn't there. Building after building was searched without avail. Finally some one went into the Agricultural Building, about the last place one would expect Edison to visit. The searcher passed down one of the side aisles and there beheld Mr. Edison with a pancake in one hand and a cracker spread with jelly in the other. He was quietly enjoying his lunch.

The attendance at the World's Fair is perceptibly and gratifyingly increasing. Last Saturday nearly 150,000 people paid admission, and with even moderately good weather each succeeding week day should register close to or above these figures. The attractive programme of special features arranged for each day seems to meet the approval of the people, and one way to get crowds here would seem to be to Barnumize the Fair a little more. F. D. Millet, the well known artist, is doing wonders in this direction, and it is to be hoped the good work will be kept up.

Not since the Centennial Exhibition in 1876, when Alexander Graham Bell presented his first speaking telephone to the world, has there been a good opportunity for the public to inspect critically the telephone industry. The American Bell Telephone Company has seized upon the chance offered by the World's Fair to make its patrons and the general public acquainted with every detail of its business that can properly be of interest to them. In the telephone temple at the south end of the Electricity Building on the ground floor, the progress of the art of telephony is clearly exposed by statistical maps and diagrams, original and model apparatus of every description, and the World's Fair telephone exchange in practical operation, with every detail thrown open to view.

In the east peristyle of the temple is exhibited a historical collection of telephones giving the history of the art from the beginning. A printed card and sectional drawings attached to each instrument afford full information of the uses and development of the apparatus. There are also on the walls, maps and statistical diagrams showing in a very lucid manner the growth of the telephone industry in the United States.

In the west peristyle is located the Chicago Telephone Company's complete World's Fair exchange, showing the underground cable terminals, lightning arresters, distributing frames and switchboard. The strain on this exchange is very severe, the operating conditions being about the same as if the exchange was located out doors.

The exhibit also includes the wonderful radiophone, the long distance telephone sets used by Professor Bell at the opening of the New York-Chicago line and Governor Russell at the opening of the Chicago-Boston line, a diver's telephone, which will operate under 70 feet of water, several marine telephone sets for use on shipboard, a mine telephone impregnable to moisture, automatic telephone exchanges, photographs of telephone exchange buildings in all the principal cities, and photographs and drawings of difficult line construction and underground work. In a central apartment there are 32 hand telephones connecting with the German Village in the Midway Plaisance. Every afternoon and evening the concerts of the German Military Band may be heard through these telephones. An interesting photograph is that of an overhead line through Mosquito Pass, Colorado, where 159 poles to the mile were used in construction. This line was downed regularly by the elements and now an armored cable laid right on the ground performs the service without interruption.

Mr. A. G. Fuller, of the American Bell Telephone Company, who is in charge of this exhibit, has just received two interesting and very finely executed maps showing the telephone subway systems of New York and Boston. These maps have developed some statistics which have never before been published.

Here they are: In New York city there are 53½ miles of streets in which telephone conduits are laid; there are 765 miles of single duct, 247 miles of cable in subways, 27,957 miles of wire and 1,019 manholes. The figures for Boston are: 22 miles of streets occupied by conduits, 188 miles of single duct, 71 miles of cable in subways, 8,148 miles of wire and 465 manholes.

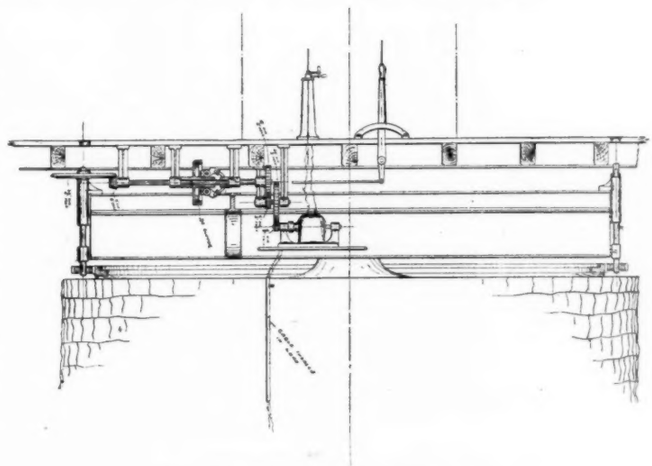
"The motive of the American Bell Telephone Company in making this exhibit is purely educational," said Mr. Fuller. "It is not designed as an advertisement. We believe it is better for us and better for the public that a thorough understanding be arrived at of the amount of expense and labor attached to the operation of a telephone exchange. Every local exchange gladly welcomes its subscribers to an inspection of its plant, but as the local exchanges are usually very busy it was desired to present an opportunity for the public to examine and study the telephone industry at their leisure. In this exhibit the American Bell Telephone Company presents such an opportunity."

The American Telephone and Telegraph Company makes an exhibit of the long distance telephone in the Bell telephone temple. Mr. Wendell Baker is in charge. Every afternoon the public may talk free of charge between Chicago and New York. Many are the expressions of wonder and astonishment called forth by the splendid performance of this line. An example of the promptness and efficiency of this service is afforded in the fact that in a little over two minutes conversation was established between the Bell telephone exhibit and the ELECTRICAL REVIEW office, in New York city.

The General Electric Company has framed and ready for distribution about the Fair a number of announcements printed in large type informing the public that this company furnished to the World's Fair all the electrical apparatus used in the construction of the Fair, the generators and motors for the Intramural elevated electric railway, the storage batteries and appliances for the electric launches, the apparatus for the electric fountains, the electrical equipment for the battleship "Illinois," the electrical apparatus for the moving sidewalk, and all the appliances for the Edison tower of light in the Electricity Building.

STEPHEN L. COLES.

World's Fair, August 19.



ELECTRIC MOTOR AT RED BRIDGE, R. I.

ELECTRIC RAILWAY AND POWER NOTES.

J. A. Folsom, of Minneapolis, has invented an insulated trolley wire for which great claims are made.

The new power house of the East St. Louis, Ill., Electric Railway Company is nearly completed, at a cost of about $50,000, including machinery.

A stroke of lightning during last week's big storm burned out an armature in a 2,500 light dynamo belonging to the Hudson Electric Light Company, Jersey City.

The thing that was expected of the Chicago and Central Indiana Electric Railroad Company has happened. Mr. E. J. Pennington's magnificent $10,000,000 bubble has burst, and the remnants of it, like the promoters, have dissolved in thin air.

The municipality of Cote St. Louis, which is now considering the advisability of granting a bonus of $30,000 to the Royal Electric Company, on conditions that they erect workshops there, have agreed to take the burden solely upon themselves by paying $1,000 a year, should they be annexed to the city of Montreal.

Representatives of all the electric or horse railroads in Maine met last week at the Portland Railroad Company's office in Portland and formed an association to promote the interests of the roads. The officers are: President, W. R. Wood, Portland; directors, W. R. Wood; F. N. Twitchell, Bath; A. F. Gerald, Waterville; J. M. Haynes, Augusta; G. E. Macomber, Rockland; E. H. Banks, Biddeford; E. K. Day, Sanford; S. W. Fife, Freyburg; F. W. Laughton, Bangor; F. W. Dana, Lewiston.

Electric Motor at Red Bridge, Rhode Island.

The machinery for operating the pivot draw of the Red Bridge, spanning the Seekonk river, Providence, R. I., was started on the 7th instant, and is performing the required service in a most satisfactory manner. The Malden Machine Company, of that city, are the contractors, and the work was designed by their consulting engineer, Lemuel Porter. The plant consists of a seven horse-power Holtzer-Cabot railway motor, a 24-inch Hargrave's clutch and a train of gears connecting with four inch steel pinion on armature shaft, this engaging a 24-inch spur gear operating a 6-inch pinion on the spur gear shaft, which in turn engages an 18-inch spur gear on the main shaft. This main shaft is bisected by the clutch, and on the outer end a 6-inch bevel pinion engages a 36-inch bevel gear, which latter is attached to the upper end of the vertical shaft, on the lower end of which is a 12-inch spur pinion which engages the segment gear 24 feet in diameter, attached to the central pier. The whole of this machinery is located below the deck of the bridge, and attached to the iron frame with which it revolves in operating the bridge. The current is brought to the western approach of the bridge, where a cut-out box is located, and from thence the current is conveyed through a cable, which dropping down beneath the pier crosses the channel, being anchored on both sides of the same, and rising from the river bottom inside the sheathing of the middle pier. At the top of the mason work, a passage is made beneath the carrying track and segment through which the cable is passed, and carried to the central support or step of the pivot draw. Upon the outside of this cone, two copper bands are attached by glass insulators, and form a trolley track, the current being conveyed to the motor from this track by a peculiarly formed copper brush, arranged to move in either direction without bending or crippling. In one corner of the deck-house, a specially constructed rheostat is located, and immediately at one side of the same is a lever connecting with the clutch, which latter serves the double purpose of connection and brake. The operation of the plant is exceedingly effective, the bridge being entirely in the hands of the operator, while at no time during the trial was there more than one-quarter of the power of the motor in use.

The draw, which weighs 130 tons, is 210 feet in length and makes an entire revolution in two minutes.

The electric work was performed by the Gannett Electric Company, of Providence, and the 500 volt current is supplied by the Narragansett Electric Company.

There are two other bridges in Providence which are operated by power, the Point street bridge by steam power, and the Washington bridge by hydraulic power, the motor being similar to the Otis system of water elevators. From the present indications this electric plant would seem to be a marked improvement upon either of those named, both in simplicity of construction and efficiency of operation.

Clamiana.

The electrical fraternity last week received legal blue subpœnas reading this way:

You are invited to be present at the
Fifteenth Annual Rhode Island Clam Dinner,
tendered to the Electrical Fraternity
by the American Electrical Works,
of Providence, R. I.,
at Haute Rieve,
on Saturday, September second, 1893.
Lunch at 11.30. EUGENE F. PHILLIPS,
Bake opens at 2. *President.*

The honorary committee is composed of Nelson W. Aldrich, Providence; H. F. Stevens, New York; A. D. Newton, Windsor; A. J. De Camp, Philadelphia; Lemuel Bannister, Pittsburgh; Henry F. Woods, Boston; John I. Sabin, San Francisco; A. C. White, Providence.

The reception committee is W. A. Hathaway, C. H. Wagensell, F. B. Baker, W. H. Sawyer, C. R. Remington, Jr., A. L. Capper, P. C. Ackerman, E. Rowland Phillips, John Carroll.

THE ELECTRICAL CONGRESS.

(Continued from page 15.)

conduct the next day, Saturday, in the rooms of the Westinghouse exhibit in the Electricity Building.

A vote of thanks was then extended to Mr. Tesla, and the visitors dispersed to their homes feeling that a new field had been opened by this young and vigorous explorer in the realms of electrical science.

The Banquet.

The American electricians entertained the foreign delegates to the International Electrical Congress at the Grand Pacific Hotel on Thursday evening, August 24. About the banquet board were gathered the foremost electrical scientists of the world. Dr. Elisha Gray was toastmaster. Dr. Hermann von Helmholtz responded to the "International Electrical Congress."

"Our Guests, the Official Foreign Delegates," was the theme on which W. H. Preece spoke in English, Prof. E. Mascart in French and Prof. Ferraris in Italian. Prof. W. E. Ayrton, of London, responded to "The American Electrical Engineers." The other speakers were:

Prof. E. J. Houston, president of the American Institute of Electrical Engineers; Prof. Sylvanus P. Thompson, of London; Dr. T. C. Mendenhall, of Washington; T. D. Lockwood, of Boston; Dr. Lindeck, of Berlin; Prof. H. A. Rowland, of Baltimore; Prof. Elihu Thomson. Thomas A. Edison was called upon, but declined to respond.

Attendance at the Congress.

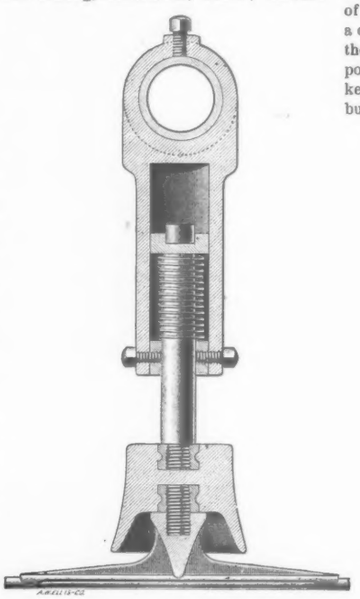
Among those noticed at the Electrical Congress were the following:

Dr. von Helmholtz, Alex. Graham Bell, Prof. Elisha Gray, Prof. Elihu Thomson, Prof. W. E. Ayrton, Dr. T. C. Mendenhall, Washington, D. C.; Dr. Arthur G. Webster, Worcester; Camillo Olivetti, Turin, Italy; Prof. Francisco Grassi, Milan; Prof. Galileo Ferraris, Turin; Prof. Jamieson, Glasgow, Scotland; L. M. Hancock, Chicago; E. Sederholm, Stockholm; Otto Lemisch, Klagenfurt, Austria; Robert McAlloyd, New York; Dr. W. E. Geyer, Hoboken, N. J.; B. J. Arnold, Chicago; Dr. Schrader; Dr. Chas. Poliak, Frankfort; Dr. W. Wedding, Berlin; John Cassidy, Honolulu; Dr. Frederick Bedell, Ithaca, N. Y.; Prof. Edw. L. Nichols, Ithaca; Carl Hering, Philadelphia, Pa.; Prof. F. B. Crocker, New York; Geo. P. Lowe, San Francisco; Alex. Siemens, London, Eng.; B. Rosa, Middletown, Conn.; W. W. Ryder, Chicago; Dr. Chas. E. Emery, New York; Wm. Mayer, Jr., New York; Geo. T. Gibson, Des Moines; Thos. D. Lockwood, Boston; M. E. Rice, Lawrence, Kas.; Wm. Elmer, Jr., Princeton, N. J.; H. W. Frund, Vincennes, Ind.; Herman Lemp, Lynn; Geo. A. Hamilton, New York; Holbrook Cushman, New York; J. Edward Lisson, St. Petersburg, Russia; A. L. McRae, Rolla, Mo.; Dr. Chas. E. Doremus, New York; C. Courtney, Wharton, Cinti.; Dr. F. A. C. Perrine, Palo Alto, Cal.; Wm. J. Danielson, Providence, R. I.; L. P. Hall, New York; Fredk. Reckenzaun, West Hoboken; W. H. Preece; Prof. H. A. Rowland, Baltimore; J. R. Cullinane, Dennison, Tex.; F. McCarthy, Chicago; Joseph Wetzler, New York; Max Levy, Galveston, Texas; Dr. E. Voit, Munich; Geo. P. Squirs, U. S. Army; Luiji Lambardi, England; Dronero Cuneo; Walter S. Wiley, South Omaha, Neb.; Chas. W. Livermore, Manchester, N. H.; J. Violle, Paris; Ludwig Weber, Frankfort, Germany; L. Eddy, Danville, Ky.; Capt. L. Sventorzetcary, St. Petersburg; Prof. Edwin J. Houston, Philadelphia; Camilto Cerrati, Turin, Italy; Tito Galvao, Rio de Janeiro, Brazil; J. W. Sterns, Jr., Denver; Ormond Wyman, Ottawa; J. W. Johnson, New York; Cecil P. Poole, Va.; A. F. McKissick, Auburn, Ala.; Harry M. Palmer and J. J. Thoresen, Washington, Pa.; Alfred E. Wiener, Schenectady; E. L. Zalinski, U. S. Army; Stephen D. Field, Stockbridge, Mass.; H. H. Fairbanks, Worcester; Capt. A. de Khotinsky, Marlborough, Mass.; Jas. Allen Pentz, Philadelphia; Major Capel L. Holden, Woolwich, Eng.; Major A. H. Bagnold, R. E. Chatham, Eng.; F. A. Wessel, New York city; Edwin R. Weeks, Kansas City; Francis W. Willcox, Atlanta, Ga.; A. Langstaff Johnston, Richmond, Va.; A. Wickenheise, Pokor, Russia; Otto Frick, Malmoe, Sweden; Douglas Burnett, Brooklyn: Ludwig K. Bohm, New York; Lieut. W. F. C. Hasson, San Francisco; E. G. Acheson, Pittsburgh; D. B. Grandy, St. Louis; Austin M. Knight, U. S. Navy; Hermann S. Hering, Baltimore; Chas. F. Kent, Chicago; C. M. Goddard, Boston; F. E. Cabot, Boston; Dr. Johann Sahulka, Vienna, Austria; Keno Thurnauer, Nuremberg, Germany; E. Braun, Clarendon Hills; Prof. Josef Pechan, Richenberg, Austria; H. C Parker, Brooklyn; M. D. Law, Washington, D. C.; Frank T. Lyman, Cincinnati; W. S. Jenks, New York: A. Sutton, Rye, N. Y.; E. A. Wheeler, N. Y.; Gano S. Dunn, New York; S. D. Mott, Passaic, N. J.; Dr. S. S. Wheeler, New York; Julian A. Moses, ELECTRICAL REVIEW, New York; Geo. M. Phelps, New York; Jas. Waring, Manchester, Conn.; Edward A. Colby, Newark; W. B. Cleveland, Chicago; R. Reckenzaun, Yonkers; Carl P. Siemens, Berlin; Chas. F. Scott, Pittsburgh; P. B. Delany, South Orange; C. A. Mailloux, New York; E. E. Bernard, Troy; L. B. Marks, New York; L. L. Summers, Chicago; F. W. Jones, New York; Chas. P. Steinmetz, Lynn; H. L. Rodgers, Windsor, Conn.; H. A. Reed, New York; C. H. McIntire, Newark; F. E. Jackson, Newark; Prof. E. P. Roberts, Chicago; Hammond V. Hayes; T. W. Voeter, Pittsburgh; Harold B. Smith, La Fayette, Ind.; W. E. Goldsborough, Fayetteville, Ark.; J. A. Cabot, Cincinnati; Henry W. Frye, E. W., New York; A. Buys, N. J.; Keijiro Nakamure, Private Secretary to Mr. Nirva; Lewis Searing, Denver, Colo.; J. L. Jayne, U. S. Navy; I. H. Farnum, Boston; H. Bergholtz, Ithaca; Frank C. Perkins, Buffalo; Chas. Cuttriss, New York; C. O. Baker, Jr., New York; D. George Finze, Milan; E. L. French, Pittsfield; M. J. Bulkley, ELECTRICAL REVIEW, Chicago.

The Laclede Electric Works, P. C. Burns & Company, proprietors, will remove from Peru to Kokomo, Ind., at an early day.

New Electric Trolley Hanger.

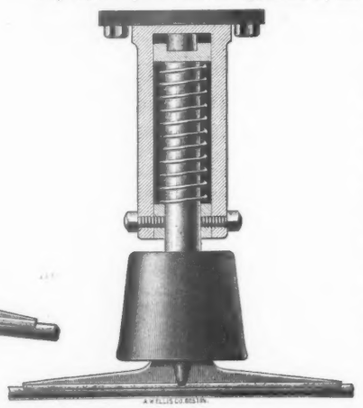
The American Bolt Company, of Lowell, Mass., manufactures a new hanger designed for use on bracket arms and bridges, also under elevated railroad structures, its chief object being to furnish an elastic and yielding support for the trolley wire. It is made of iron, the lower part being in the form of a cylinder, and contains a spring and spindle; the spring is made the proper tension to support whatever weight is required, and is kept in place in the cylinder by means of a bushing, which is fastened in the lower part of the cylinder with set screws; the spindle passes through the bushing and spring; the head of the spindle is on the upper end of the spring; the lower end is threaded and screws into the top of the insulator, to which the ear and trolley wire is fastened.



FIGS. 1 AND 2.—NEW TROLLEY HANGER OF AMERICAN BOLT COMPANY, LOWELL, MASS.

The weight of the trolley wire, ear and insulator varies from 30 to 40 pounds on each hanger, according to the distance the poles are set apart; this weight on the hanger sets the spring spoken of above.

The pressure of the trolley on the under side is anywhere from 8 to 12 pounds, the pressure depending on the speed of the car and the condition of the track; now, when the trolley is passing the hanger, with its pressure of 8, 10 or 12 pounds, as the case may be, the spindle moves up, aided by the tension or strength of the spring, thereby forming a cushion and saving the hard blow which the trolley would give to a rigid hanger; this being the case, it is quite easy to see where a large amount of wear and tear on the trolley is overcome, and then the saving in the breaking of insulators and consequent leakage of the current, also the disagreeable noise in the car.



FIGS. 3 AND 4.—OTHER VIEWS OF THE TROLLEY HANGER.

The hanger is used on several lines of the Lowell and Suburban Street Railway, where it is giving the best of satisfaction. Several views of the hanger are given herewith.

Improvements in the Art of Cable Making.

BY EMIL GUILLEAUME, MULHEIM, GERMANY, AT THE CHICAGO MEETING OF THE MECHANICAL ENGINEERS.

The art of cable making has received an increased impulse during these last 10 years from the wonderfully extended application of electricity for telegraphic and telephonic service, for electric lighting and transmission of power, as well as from the growing necessity of placing the leads under ground. The numerous patents which have been and which still are applied for, are the best proof of the attention given to this art. It would be going too far to discuss all the inventions which refer to improvements in cable making; for the most part they are of very little, if any, practical importance, and of the few which have stood the practical test only a small percentage may claim the character of a striking novelty.

The term "electrical cable" ought, strictly speaking, only to apply to an electrical conductor, insulated and dressed, or sheathed in such a manner as to have the appearance of a rope or cable and to coil like one; lately, however, this term has been extended to include insulated rods and tubes, such as the well known Ferranti cable.

Every cable for the conveyance of electricity is composed of the cable core (one or more insulated conductors) and the protecting armor or sheathing, and I will discuss these two principal parts of an electrical cable separately.

THE CABLE CORE.

The cable core is composed of the conductor (leading wire) and the insulating covering.

The conductor may be formed of a single wire or of a number of wires formed into a strand or rope. The wire or wires may be of circular or of any other section; as a rule it will be made of copper of high conductivity, and only in exceptional cases, where, besides conductivity, a more or less high tension strength is claimed, copper compounds (alloys) and steel are made use of.

Important progress has been made in the manufacture of copper wire of almost absolute pureness, and accordingly high conductivity. Whereas, formerly one had to be content with copper wires with a conductivity of 90 per cent. of that of pure copper, we have now copper wire at our disposal which yields more than 100 per cent.; *i. e.*, purer than the copper Matthiessen considered to be pure copper, when he took it as his standard for determining the pureness and conductivity of copper leading wires.

Other notable novelties respecting the conductor are confined to the shape or section of the wire. Thus, my firm (Felton & Guilleaume, of Mulheim-on-the-Rhine) has been granted patents for telephone cables of low capacity in which the leading wires of the core are of a triangular, rectangular or star-shaped section. The wire is twisted round its own axis, and the spiral grooves thus formed on the surface of the wire allow the insulating material to touch only the top edges of the grooves, the latter themselves forming air spaces between the insulating material and the spirally wound sides of the wire. My firm also manufactures electric light cables in which the conductor is composed not of round wires but of wires of segmental section, in order to do away with the empty spaces between the wires, and thus materially reduce the diameter of the core as well as the diameter, weight and price of the cable. Others have for the same purpose proposed to deform the leading wire longitudinally, *i. e.*, instead of using straight wire to corrugate it or bend it into a zigzag: such proposals, however, can hardly be seriously considered.

The insulation or insulating material is the vital part of any cable, and yields the most fertile working field for the ingenuity of cable engineers. The claims on the properties of the insulating material are so manifold that it is often very difficult to combine them in one material. According to the use

of the cable, whether for telegraphic or telephonic service, for electric lighting or transmission of power, more or less high claims are put on the insulating material as to the insulation resistance, the absence of static capacity, the prevention or reduction of the disturbing influence of induced currents, the tension resistance. The insulating material must preserve the claimed properties for as long a space of time as possible; it must not soften under the influence of heat, it must not get brittle under the influence of cold; it must at all time and in any position of the cable retain the conductor in its central position in the core; it must, further, possess a given tensile strength, sufficient power of resistance against external pressure; the size and the weight may be of importance, and must be taken into consideration; also the price.

The high price of gutta-percha and india-rubber compelled cable engineers to look for substitutes which might be had in any desired quantity at a reasonable price, and possessing the qualifications for the various purposes of application; viz., low capacity for telephonic purposes, and sufficient strength to withstand the effects of heat and high tension for electric light purposes.

Numberless are the inventions made and the patents claimed in this direction. All of these deal with specially prepared mineral and vegetable oils, bitumen, resin, wax, etc., or mixtures of one or more of these with other preferably carbonaceous substances. All of them are, however, more or less poor substitutes for gutta-percha or india-rubber; they do not possess the valuable tough elasticity; they either soften under the influence of warmth or get brittle under the influence of cold, or they shrink in time and crack, etc. The first great step forward in this direction was the employment of fibrous material in connection with the above substances, the wire being served with a winding or braiding of thread, or a wrapper of tape and finally of paper, and this serving being impregnated with one or the other or with mixtures of the aforesaid substances. The serving of thread, tape, or paper retains the wire in its central position in the core, and the impregnation of the serving with oil, resin, wax, etc., or their compounds, yields the desired insulation resistance. In some cases the impregnation may be dispensed with, as the dry fibrous material offers in itself a certain insulation resistance which may be found quite sufficient for the case being. By this means, the object of having cheap and yet efficiently insulated cable conductors has been attained.

As all fibrous insulation is more or less hygroscopic, it is necessary to prevent any access of moisture; this is done by encasing such cores in a lead pipe, *i. e.*, forming them into so-called lead cables with impregnated or non-impregnated fibre or paper insulation, as almost every large cable-works manufacture them now with more or less success in one or another composition.

With the ever-increasing importance of telephonic communication and with the growing want of being able to speak at greater distances through cables, it became necessary to pay particular attention to the capacity of the cable-cores, as it was found that certain difficulties which were met with when trying to speak through a cable at great distance were caused by too high a capacity. The injurious influence of static capacity is already experienced on comparatively short telephone cable lines, inasmuch as the transmitted sounds are much more weakened than in passing through aerial lines; indeed, the result was such that at first it was given up as a hopeless case to use cables for long distances. Cable-makers were thus put to the task of inventing telephone cables in which the static capacity was to be reduced to a minimum, *i. e.*, in which the conducting wire is covered with an insulating material which, as regards static capacity, would yield the most favorable results. Atmospheric air gives, as is well known, the best result; next comes paper, then paraffine (twice the capacity of air) cotton, silk, india rubber, gutta-percha and glass (from six to 10 times the capacity of air). A cable in which the conductors were surrounded by air would, therefore, give the best results as far as static capacity is concerned; but as the conductor cannot be kept central without a support of some sort or other, the best cable would be such in which the conductor was kept central in a pipe filled with air by the aid of the least voluminous supports, the latter composed of a material of the lowest possible static capacity, or in which the conductor itself was of such a form as to touch the insulating shell (pipe or tube) with the least possible portion of its surface. Of this latter alternative I have spoken before as a reason for using either twisted wire of a triangular, rectangular, or star-shaped section, or corrugated or zigzag wire.

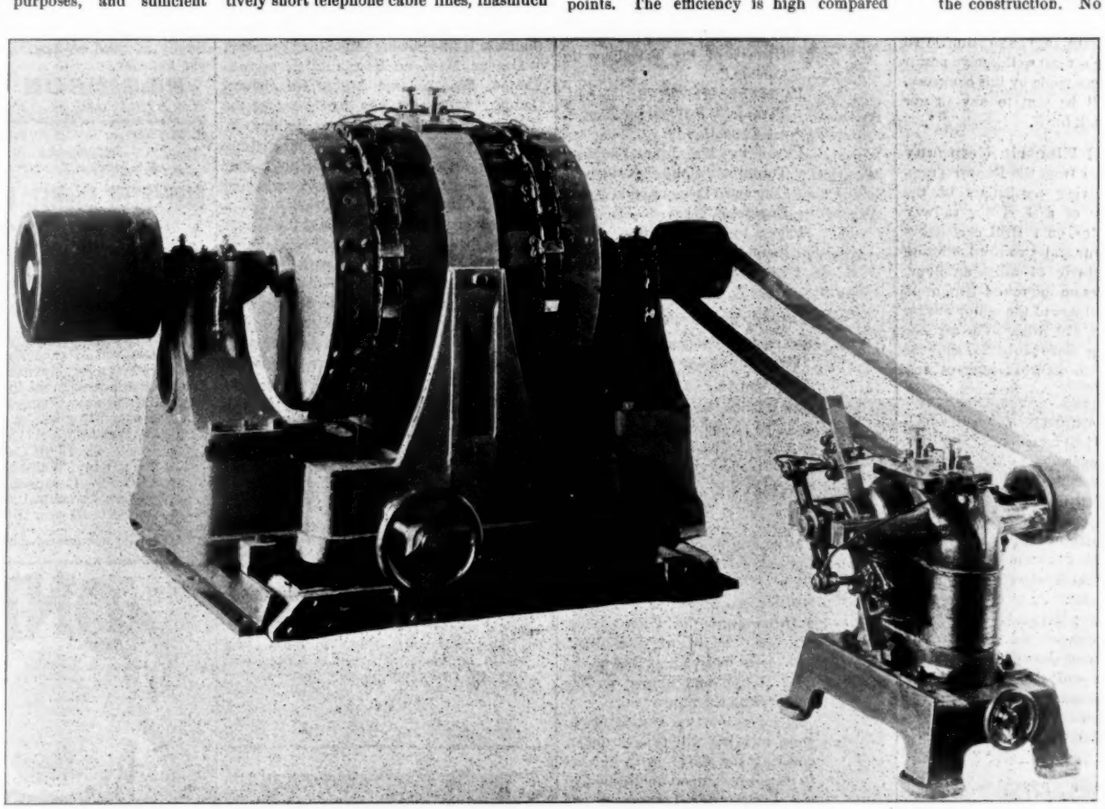
(To be continued.)

The Royal Alternating Current Dynamo.

The alternating current dynamo illustrated herewith is manufactured by the Royal Columbian Electric Company, who have recently entered the electric manufacturing field well equipped for business. This company has its main office in Chicago, at 58 Dearborn street, while its works are at Peoria, Ill. The company is capitalized at $50,000, and its officers are as follows: H. H. Natwick, president; J. I. Stene, treasurer, and H. R. Fish, Jr., secretary. The Royal Columbian Electric Company has a contract with the Royal Electric Company, of Peoria, Ill., for the entire output of the latter's factory. Mr. Natwick, the president, is well known in Chamberlain, S. D. Mr. Stene, the treasurer, is president of the Sioux Reservation Land Company. Secretary Fish is a thorough business man, and is well known in electrical circles as the president of the Royal Electric and Water Company, of Lake Mills, Wis.

The Royal dynamo is a unique machine in its class, and embraces several meritorious points. The efficiency is high compared with other dynamos of its kind, and in practical operation is said to be very satisfactory on account of the simplicity of the machine. It is well built of first-class material, and there are no wearing parts, except the two bearings, which are larger than usual and self-oiling. The characteristic feature of the machine, as claimed by the company, is that the current is generated without revolving the armature or the field magnets. Therefore, the current is taken from the dynamo without the use of commutator rings or brushes. The parts that revolve with the shaft are the magnet core and the two pole pieces in the form of disks. It is claimed that in this manner a much better and stronger insulation can be maintained, which, of course, is of the greatest importance in high tension dynamos. The regulation is said to be very close. A shunt dynamo is used for the exciting circuit with a resistance divided into a large number of small units in the shunt field circuit of the exciter. The exciter can be so adjusted as to vary the exciting current to compensate for all the differences arising from loss of speed in motive power, drop in line and the losses in the machine itself, thus keeping the electromotive force at the lamps constant.

The Royal Columbian Electric Company is bringing its products into the market in a very forcible manner, and, with the progressive business methods which it has already shown, should become a prominent factor in the business.



THE ROYAL ALTERNATING CURRENT DYNAMO, MADE BY THE ROYAL COLUMBIAN ELECTRIC COMPANY, CHICAGO.

ADVANCE INFORMATION.

New Electric Companies Formed and Important Constructions Projected.

VALUABLE INFORMATION FOR MANUFACTURERS AND DEALERS.

We publish below the earliest information obtainable relating to new electric railways, new electric light companies and projected electric construction of all kinds. Every reader will find these columns of special interest, and manufacturers and supply houses will receive many valuable suggestions looking to new business by carefully watching this department in the ELECTRICAL REVIEW from week to week.

ALLENTOWN, PA.—H. S. Cavanaugh, a director of the Philadelphia and Allentown Electric Trunk Railway Company, in answer to a letter from the Secretary of Internal Affairs, states that the whole project has been abandoned because of the lack of funds needed for the construction. No part of the road has been or will be built, and all franchises acquired by the company have become null, void and of no effect. The company was organized last January, with a capital $400,000, half of which is said to have been paid in, and the road was abandoned because the financial stringency prevented the sale of the Company's bonds.

NOBLESVILLE, IND.—The Chicago and Central Indiana Electric Railway Company, which proposes to construct an electric line between Indianapolis and Noblesville, and eventually to Chicago, and build branch lines from Noblesville to Tipton, Kokomo, Logansport and Peru; another from Noblesville to Marion, Huntington and Fort Wayne, and a third from Noblesville to Elwood and Anderson, involving the expenditure of $10,000,000 and the construction of 500 miles of track, is beginning to excite a great deal of attention. The company is proceeding in a business way, and is expending a great deal of money and asking no favors. The daily expenses of the company are over $2,000.

BIRDSBORO, PA.—The Birdsboro Electric Railway Company has been granted a franchise by the borough council.

MILWAUKEE, WIS.—The Milwaukee and Wauwatosa Motor Railway, now using steam power, will be operated shortly by electricity.

KINDRED INTERESTS

The Bryant Electric Company, Bridgeport, Conn., under date of August 1, have issued a new price list of their electrical specialties for incandescent lighting. It illustrates and describes Paiste, Bryant, K. W., and other switches, rosettes, etc.

W. R. Brixey, manufacturer of Day's Kerite wires and cables, has sent out as souvenirs of his World's Fair exhibits copies of the official catalogues of the exhibits in the Electricity Building. This is a very timely stroke on Mr. Brixey's part and will undoubtedly be appreciated.

The Dodge Manufacturing Company, of Mishawaka, Ind., have sent us a beautiful World's Fair souvenir, giving a history of their business with pictures of their plant. There are also illustrated descriptions of the several well known power transmission devices made by this company. The souvenir will be sent to any of our readers who will ask for it.

The General Electric Company has received a letter from the Denver Tramway Company giving particulars of the good performance of a G. E. 800 railway motor. This motor, on a Brill car, makes a round trip of four and two-third miles in 20 minutes, or nearly 14 miles an hour. There are 16 curves on the round trip, or 48 per hour. The mileage of the motor during 18 hours is about 270 miles. The car has not missed a trip since July 21, and the motor stands up to its work without any undue heating.

Queen & Company.—This Philadelphia company has just issued a fourth edition of its electrical apparatus catalogue, which illustrates very forcibly the enterprise of American manufacturers in producing high grade instruments to compete with "all comers." Printed upon excellent paper, the well executed cuts produce a remarkably pleasing effect, while the descriptive matter is clear and concise. A number of new standard instruments designed in the Queen laboratory are here shown for the first time, and are sure to attract deserved notice from college professors and electrical engineers throughout the country. Examples of all the important pieces are exhibited by the company at the World's Fair.

Handsome Apparatus.

We are in receipt of a very handsome album illustrating some of the standard apparatus manufactured by the Westinghouse Electric and Manufacturing Company, bearing the imprint of Bartlett & Company, the well-known engravers and printers. This series of illustrations is unaccompanied by any details, but these may be obtained upon application at the company's office in Pittsburgh, Pa. Some of their recent Columbian apparatus is here shown, and among the 50 excellent engravings will be found many of their interesting specialties. The whole piece of work, from an artistic and practical standpoint, is one in which the company may take a pardonable pride.

Large Electric Railway in Trouble.

The Sandusky, Milan and Huron, Ohio, Electric Railroad has been placed in the hands of J. C. Gilchrist, of Vermillion, as receiver. The road is one of the largest electric lines in the country. The failure of Cleveland capitalists to take $75,000 of the company's bonds as promised embarrassed it to such an extent that it could not meet the demands of creditors and the receivership is the result. The company is solvent, owning property worth twice as much as its liabilities.

Third Convention of the Canadian Electrical Association.

The third convention of the Canadian Electrical Association will be held in the Industrial Exhibition Association's Buildings, Toronto, on Tuesday, Wednesday and Thursday, September 12, 13 and 14. The programme of proceedings has been arranged as follows:

TUESDAY, SEPTEMBER 12.

2 P. M.—President's Address.
Secretary-Treasurer's Report.
Report of Committees.
General Business.
Paper by Mr. Fred. C. Robertson, Toronto. Subject: "Some of the Causes of Interruption to Telegraph Circuits."
Paper by Mr. A. C. McCallum, of Peterboro. Subject: "Water Wheels."

WEDNESDAY, SEPTEMBER 13.

10 A. M.—Nomination and Election of Officers, and selection of place of next meeting.
Unfinished Business.
Paper by Mr. L. B. McFarlane, of Montreal. Subject: "The History of the Telephone in Canada."
Paper by Mr. E. B. Merrill, Toronto. Subject: "Electrical Education."
Paper by Mr. John Langton, Toronto. Subject: "Direct Connected Dynamos and Steam Engines."
Paper by Mr. E. Carl Breithaupt, of Berlin, Ont. Subject: "Electric Street Railways."

THURSDAY, SEPTEMBER 14.

7 A. M.—Steamer of Niagara Navigation Company to Queenston.

By courtesy of Mr. W. A. Grant, manager, a special car will be taken on the Niagara Falls Park and River Electric Railway from Queenston to Chippewa, and inspection made of the power houses and plant.

Also by invitation of Capt. Carter, the members will visit the Falls at Table Rock and Prospect Park, the works in the Tunnel District, the Tower, etc., and take a trip around the Falls on the Steamer "Maid of the Mist." Luncheon will be provided at the Cliff House, and dinner on the boat during the return trip.

Members of the Association in good standing will receive tickets covering the above, without cost to themselves, upon application to the secretary. Ladies' tickets may also be obtained by members for $1.50 each.

Wallace & Sons Suspend.

Wallace & Sons, manufacturers of brass and copper goods at Ansonia, Conn., with offices at 29 Chambers street, extending through to Reade, have been forced to suspend on account of the hard times, and their affairs have been put in the hands of receivers. Thomas Wallace, of Ansonia, the treasurer, and Robert M. Thompson, president of the Oxford Copper Company, have been appointed receivers, both in this State and Connecticut, on the application of John B. Wallace, the secretary, and Uri T. Hungerford, the manager of the New York office.

The business was established in 1848 at Ansonia, and was incorporated in 1853 with a capital of $100,000. It is a close corporation, the stock being held by the Wallace family and Mr. Hungerford. They have large rolling mills, wire mills and factories at Ansonia. The cost of the plant and machinery, it is said, exceeded $1,000,000, and the property is unencumbered. They employ from 1,000 to 1,400 hands. The mills were shut down week before last, but resumed again last Monday. The company could not meet a note for $25,000 which fell due last week. Notes to the amount of $50,000 fall due before September 1, and the rest of the notes out mature in the next two or three months. The company was unable to make collections. Liabilities are placed at $875,000, of which $450,000 is on open accounts, nearly all of which are past due, and $425,000 on notes. The nominal assets are put down at $2,000,000, of which the plant and machinery are valued at $1,000,000, book accounts $600,000, which are supposed to be good, and merchandise $400,000, of which about $50,000 is in this city.

The Berlin Iron Bridge Company.

In times like these when almost every manufacturing concern is complaining of hard times and lack of orders, it does one good to find that there is occasionally a concern which is running full time and has plenty of orders. The Berlin Iron Bridge Company, of East Berlin, Conn., are full of orders and are running their entire plant full time and portions of their work over time. They have contracts for a large amount of work, including a new electric light and power station at Lynn, Mass., a draw bridge at Salem, Mass., a new foundry building for the New Home Sewing Machine Company, at Orange, Mass., an iron building to go to Tampa, Fla., a large bridge for Chester County, Pa., a new iron storehouse for the New York Knife Company, at Walden, N. Y., a large power plant for the Philadelphia Traction Company, of Philadelphia, Pa., a large cotton shed for the Southern Pacific Railroad Company, at New Orleans, La., a new roof for the purifier house of the Northern Liberties Gas Company, at Philadelphia, Pa., a new power house for the Reading Traction Company, of Reading, Pa., a new power house for the State Street Horse Railway Company, at New Haven, Conn., a car barn for the Easton Transit Company, at Easton, Pa., a large smelter building for the Anaconda Smelting Company, at Anaconda, Mont. Besides these they have numerous small jobs scattered throughout the country which will employ their entire plant until after January 1. The company seems to be particularly fortunate in securing work like this at this time.

WANTED.

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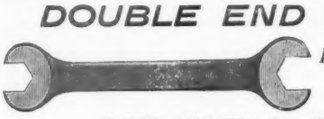
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